Iranian Journal of Pharmaceutical Research (2008), 7 (2): 93-99
Received: January 2008
Accepted: February 2008

Review Article

History of Medical Sciences in Iran

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Abstract

The practice and study of medicine in Persia has a long and prolific history. The ancient Iranian medicine was combined by different medical traditions from Mesopotamia, Egypt, India, China and Greece for more than 4000 years and merged to form what became the nucleus and foundation of medical practice in the European countries in the 13th century. The Iranian academic centers like Jundishapur University (3rd century AD) were a breeding ground for the union among great scientists from different civilizations. These centers successfully followed their predecessors' theories and greatly extended their scientific research through history. Iranian physicians during the glorious Islamic civilization had a tremendous share in the progress of medical sciences. The excellent clinical observations and physical examinations and writings of Iranian scientists such as Rhazes (Al-Razi, 865-925 AD), Haly Abbas (Ali ibn-al Abbas-al Majusi, died 994 AD), Avicenna (Abou Ali Sina, 980-1037) and Jurjan (Osmail ibn al-Husayn al-Jurjani, 110 AD) influenced all fields of medicine The new era of medicine in Iran begins with establishment of Dar-ul-funoon in 1851, which was the only center for modern medical education before the establishment of Tehran University. Following the establishment of the Tehran university school of medicine in 1934 and the return of Iranian graduates from the medical schools in Europe, much progress was made in the development and availability of trained manpower and specialized faculties in medicine. After the Islamic revolution by the growing spirit of independence inspired by the Iranian government the number of medical schools and medical students increased more than 10 times. For the 1st time in recent modern history the Iranian medical universities started to offer post-graduate specialized degrees in basic, clinical and engineering sciences.

Medical sciences including pharmacy has a long history in Middle and Near East and goes back to the ancient Mesopotamian period (Beginning with Sumer 3000 BC). There are many cuneiform tablets from cities as ancient as Uruk (2500 BC), the city of Prophet Abraham (PBUH). The bulk of the tablets that do mention medical practices have survived from the library of Asshurbanipal at Nineveh (668 BC) Assyria. So far 660 medical tablets from this library and 420 tablets from the library of a medical practitioner from Neo-Assyrian period, as well as Middle Assyrian and Middle Babylonian texts have been published. The vast majority of these tablets are prescriptions, but there are a few series of tablets that have been labeled "treatises". One of the oldest and the largest collections is known as "Treatise of Medical Diagnosis and Prognoses." The text consists of 40 tablets collected and studied by the French scholar R. Labat (1). Although the oldest surviving copy of this treatise dates to around 1600 BC, the information contained in the text is an amalgamation of several centuries of Mesopotamian medical

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knowledge. The diagnostic treatise is organized in head to toe order with separate subsections covering convulsive disorders, gynecology and pediatrics. To the non-specialist they sound like magic and sorcery. However, the descriptions of diseases demonstrate accurate observation skills. Virtually all expected diseases exist, they are described and cover neurology, fevers, worms and flukes, venereal disease and skin lesions. The medical texts are essentially rational, and some of the treatments (such as excessive bleeding) are essentially the same as modern treatments for the same condition (2-4).

The first major Iranian dynasty, Achaemenid or Hakhamaneshian (550 BC), promoted the development of culture and science extensively. The great scholars such as the philosopher Heraclitus of Ephesus, the Babylonian astronomer Kidinnu and even the historian Herodotus were Persian subjects. The ancient cultures of the Egyptians, Babylonians, Elamites, and others continued to exist and develop. Babylonian Physicians were all over the territories and served all people including Persians. Xenophon relates that when the Greek soldiers who served under Cyrus the younger passed through the territory of Babylonia, they found sufficient number of Physicians even in the villages to treat the wounded warriors. Texts describe how physicians used medicine, prayers and magic. They would often model images of evil spirits out of clay and shatter them, in order to restore the invalid to health.

Achaemenid made Babylon one of their major capitals and extensively used the texts at the temple libraries. The library and museum at the Persepolis was build to rival the Babylonian archives famous in the ancient world. Greek and Egyptian physicians were invited to join the Achaemenid court and served the royal household. Persians also adopted the tradition of paying the physicians according to the rank and gender. The archives at Persepolis indicate that physicians and midwives who delivered boys were paid double the amount they got when the baby delivered was a girl. The records do not indicate severe punishments if the sick person died, as was the case under Hammurabi (3, 4). Texts also show lists of plants, herbs and other substances used for medicinal purposes. Drugs which were taken internally included; mercury, antimony, arsenic and sulfur. Animal fats were also prescribed. All were basically the same as Babylonian medicine and prescriptions (3, 4).

At one point Darius ordered a representative to return to Egypt in order to restore the department of the ruined house of life dealing with medicine; " While his majesty was in Elam he ordered me (Udjahorresne) to return to Egypt. I gave them every useful thing and all their instruments indicated by the writings, as they had been before. His majesty did this because he knew the virtue of this art to make every sick man recover" (5).

The subsequent Seleucid (selukian) and Parthian (Ashkanian) dynasties followed the same trends with more Greek influence science and art due to massive presence of Greeks in the area. However the flourishing of science and technology happened in the Sassanian period with major centers of learning and the famous university Jundaishapur (6, 7). The Sassanian king, Khosrow Anoshirvan is mentioned by many historians and biographers to have been a major promoter of all sciences including philosophy and medicine. In a Pahlavi text (Karnamag) he is quoted the following; *"We have made inquiries about the rules of the inhabitants of the Roman Empire and the Indian states. We have never rejected anybody because of their different religion or origin. We have not jealously kept away from them what we affirm. And at the same time we have not disdained to learn what they stand for. For it is a fact that to have knowledge of the truth and of sciences and to study them is the highest thing with which a king can adorn himself. And the most disgraceful thing for kings is to disdain learning and be ashamed of exploring the sciences. He who does not learn is not wise"* (8).

Greek Philosophers Syriac speaking Christians and Nestorian Christians fleeing persecution by Byzantine rulers were received by Anoshirvan and were commissioned to translate Greek and Syriac texts into Pahlavi. Paul the Persian dedicated Works of logic to the king. The Greek philosopher Priscianus Lydus wrote a book in response to the king's questions on a number of subjects in Aristotelian physics,

theory of the soul, meteorology and biology. The Sassanian religious text, Dinkard shows familiarity with all these topics, especially Aristotelian physics. It is apparent from the text that Aristotle's famous article "On Coming to be and Passing away" was well known by the compilers of Dinkard. Becoming, decay and transformation, the three fundamental concepts in the article, had been mentioned and discussed. Pahlavi texts also indicate that the doctors were paid according to the rank of the patient. Books in medicine, astronomy, Almagest (by Ptolemy), Aristotle's Organon and a number of texts in crafts and skills were translated from Greek. Syrian Christians in particular played a significant part in communicating Greek sciences and knowledge to the Persians (9, 10).

The famous university and the hospital at Jundaishapur built earlier reached its peak at Anoshirvan's time. The Muslim historian Qifiti (12/13th century AD) in his book 'History of Learned Men' quotes the following; *"In the twentieth year of the reign of Khosrow II (Anoshirvan) the physicians of Jundaishapur assembled for a scientific symposium by order of the king. Their debates were recorded. This memorable session took place under the presidency of Jibril Durustabad, the physician in ordinary to Khosrow, in the presence of Sufista'i and his colleagues, together with Yuhanna and a large number of other medical men"* (11).

It is likely that the medical teaching resembled those at Alexandria with some influence from Antioch. This hospital and the medical center were to become the model on which all-later Islamic Medical Schools and hospitals were to be built. Earlier Muslim historians such as Maqdisi (10th century) mentioned the medical school in Khuzistan and named its famous associates and practitioners. The famous writer and translator, Burzoyeh who translated the Indian book of fables the Panchatantra (later, Kalileh va-Demneh) for Anoshirvan, was also a well-known physician from Nishapur (10). The first recorded Muslim Physician Harith bin Kalada had studied at Jundaishapur Medical School. In Jundaishapur Greek, Indian and Persian scientific traditions were assimilated. Indian scientific material in astronomy, astrology, mathematics and medicine were also translated into Pahlavi along with Chinese Herbal medicine and religion. The books were kept at the university and the royal libraries and Greek medicine based on works by Hippocrates and Galen dominated the discipline (11).

The later Muslim historians refer to the Sassanian Imperial library as the House of Knowledge (Bayt al Hikmat). The library functioned as both a place where accounts of Iranian history and literature were transcribed and preserved. At the same time it was a place where qualified hired translators, bookbinders and others worked to preserve, purchase, copy, illustrate, write and translate books. It was such texts that made their way into the Islamic period. Many books in sciences and philosophy were translated by the Persians, Greeks, Syriac and Aramaic-speaking scholars into Arabic and eventually made their way into Muslim Spain and Western Europe. Persia and Byzantium dominated the area before Islam. The later was a continuation of the Eastern Roman Empire and the seat of Greco-Roman art, culture and civilization. Alexandria and Constantinople were major centers of intellectual activities with theaters, libraries and universities. In addition to major cities like Alexandria Constantinople and Jerusalem, intellectuals and scientists moved and carried ideas from Edessa in the west, through Nisbis and Mosul (Iraq) to Marv and Jundaishapur in Western Persia (11).

The conquest of Islam in 7th century united east and west, improved trade and boasted book publishing by introducing advanced paper making techniques from China. However, major cities and libraries were destroyed. Arabic eventually became the universal language of the empire and forced conversions into Islam threatened national identities and local cultures. The Imperial library at Ctesiphon was lost; the whole city was totally destroyed and never rose again. The destruction of such major libraries with the rise of Arabic language made it clear to the scholars and intellectuals that all pre-Islamic knowledge and national identities were in danger of total destruction and they had to be preserved. Massive and heroic efforts were made and the result was the formation of a dynamic and significant translation movement for almost two hundred years, till the 10th

century. The movement started in Damascus in Umayyad (Umavian) times, and flourished in Abbasid (Abbasian) Baghdad (754 AD). All major surviving Greek, Syriac, Persian and Indian texts were translated into Arabic and Neo-Persian. Pre-Abbasid translations from Pahlavi included major religious, literary, scientific and historical texts. Nawbakht, the court astrologer and his son Abu Sahl and other colleagues, Farazi and Tabari and many others sponsored by the Barmakid (Barmakian) family (the chief ministers to the early Abbasids who were murdered later) translated and promoted Pahlavi texts into Arabic and Neo-Persian. They were all Iranians and aimed to incorporate Sassanian culture into Abbasid ideology and guarantee the continuity of the Iranian heritage. Christian and Jewish learned families of Sassanian Persia, such as Bukhtishu and Hunyan families, were also great translators of Syriac, Greek, Pahlavi and other texts into Arabic. Both families had served at Jundaishapur University, for generations and were instrumental in founding the Adudi Hospital and Medical School in Baghdad (11, 12).

The Nestorian physician, Jabrail ibn Bakhtishu was the head of the Jundaishapur University, when he was called to Baghdad in 148 AD as the court physician to Caliph al-Mansur. He was later charged with building the first hospital (Bimarestan or Maristan) in the city based on the Syro-Persian model already established at Jundaishapur. He went back to Iran but many members of his family served the Abbasids for a long time.

Baghdad, a suburb of Ctesiphon was built in 762 by al-Mansur. The Royal library at Baghdad was based on the Sassanian model and was also called the house of knowledge (Bayt al-Hikmat) and like the Persian royal library became a center of learning and attracted scientists and intellectuals alike and many of its' directors were either Iranian or from Iranian descent. Baghdad itself became hire to the Alexandrian and Persian scientific traditions and thought. The 'Adudi' hospital was built under the instructions of the great Iranian Physician Razi (Latin Rhazes, he was from Ray) and resembled the great hospital in Jundaishapur. It is said that in order to select the best site for the hospital he had pieces of meat hung in various quarters of the city and watched their putrefaction and chose the site where the putrefaction was the slowest and the least. At its inception it had 24 physicians on staff, including specialists categorized as Physiologists, oculists, surgeons and bonesetters. Various historians have mentioned that the hospital was 'like a great castle' with water supply from the Tigris and all appurtenances of Royal Palaces (11, 13-16).

Medicine remained dominated by the Greek tradition, the first to rid the science from supernatural powers and spirits. Around 450 BC, the Italian-born Greek natural philosopher and physician Alcmaeon began forwarding the new theory that disease was caused by a fundamental imbalance in the body between certain opposed qualities, such as heat and cold (sardi/garmi), or wetness and dryness (tari/khoshki). This theory was picked up and elaborated by Hippocrates (460-377 BC) who completely disregarded the presumption of the spiritual causes of disease. He proposed that health resulted from the equal influence of four bodily "humours" that was analogous to the four elements of Greek physics (earth, water, air and fire). Blood, phlegm, and two kinds of bile were associated with four major organs; heart, brain, liver and spleen; and with the four seasons and the four ages of man: childhood, youth, maturity and old age. Deviations from perfect balance among the four produced diseases. Therapies consisted of attempting to restrain the overactive humour while encouraging the others. Five centuries latter the great Greek physician, Galen (130-200AD), concluded that blood was manufactured in the liver from material provided by the stomach. He also posited two other systems of essential fluid. One originated in the heart and was carried by the arteries. The other, 'anima' (soul or the life principle), proceeded from the brain by way of the nerve tracts. Though none are correct, nevertheless, Galen's meticulous anatomical studies and logical method provided a point of departure for the development of modern medicine. Once this Greek heritage and knowledge was translated into Arabic, it became universal and replaced most of the older traditions and schools. Greek, Persian, Arab and Indian scholars refined the

assimilated ideas and by the 12th century slow progress was made toward understanding the organic cause of diseases. The brilliant Iranian scientist Raze (845-925 AD) distilled alcohol and clearly distinguished smallpox from measles (11-13, 15, 16).

The celebrated Iranian physician and philosopher, Abu Ali Sina (Avicenna, 980-1037), wrote 100 books in many subjects including his most famous compendium, Canon of Medicine. His magnum opus is one of the classics of medicine ever written. He extensively studied herbal medicine from China, India and Persia. Avicenna like his predecessor Farabi (another well known Iranian) was an outspoken empiricist and insisted that all theories must be confirmed by experience. He argued against the blind acceptance of any authority and improved distillation techniques. Alchemists tried to convert one substance into another in order to make gold. In the process they uncovered a host of medicinal compounds and improved distillation and sublimation techniques. Another major Greek tradition based on theories of Plato and Euclid on light, opened the way to the science of optics. Human eye became the focus of study and major advances were made and eye care was improved. The Jewish Physician Masawayh practicing at Jundaishapur joined the medical school at Baghdad at the invitation of Caliph Harun-ul-Rashid and wrote a detailed book on Ophthalmology. Masawayh family produced three more prominent physicians with the most famous, Yuhanna ibn Masawayh, who wrote prolifically and 42 works are attributed to him. Another great Jewish physician who had served at Jundaishapur was Hunain ibn Ishaq. He translated the entire collection of Greek medical works, including Galen and Hippocrates. His original contributions included 10 works on ophthalmology. He was appointed the director of the royal library by Caliph al Mutawakkil. Tabbari, another major physician, migrated from Persia to Baghdad in the first half of the 9th century AD. His major work, called "Paradise of Wisdom", contained extensive information from all extant sources including Greek, Syriac, Persian and Indian and contained an extensive treatment of Anatomy (11-13).

Like their Greek predecessors, the new genre of physicians produced Encyclopedias of medical knowledge based on observation and experience. The main topics included anatomy, classification and causation of diseases, symptoms and diagnosis. Urine, sputum, saliva and pulse were observed and used to aid diagnosis. External or visible manifestations of diseases and internal symptoms like fever, headache etc were listed and studied. Therapy with drugs and herbs were used to improve the patient's conditions (11). Female practitioners and nurses that existed before Islam remained for a while but soon lost their position and only midwives continued and most had no proper training (11-13).

The flourishing of sciences and the translation movement did not last long for a number of reasons, including foreign military attacks. The sciences, including medicine, were foreign imports as far as many Arabs were concerned and met with opposition from various quarters. From the time when the translation movement began to the end of the Islamic middle ages, these sciences were either frowned upon or openly attacked by practitioners of indigenous religious and Arabic disciplines. Aristotelian logic was rejected and the adherents of the religious tradition of Kalam had no use for Neo-platonic doctrines of the followers of Greek philosophy. The 'foreign sciences', which included mathematics, astronomy, medicine, alchemy and astrology were generally felt by religious people to constitute a serious threat to religious beliefs and values of religious life. The influential religious thinker al-Ghazali (he died in 1111 AD) wrote a popular refutation of philosophy and repeatedly warned against exposing Muslims to potentially misleading rational sciences and practices (11, 15-17).

The Hanbali jurist Ibn Taymiyya (in the year 1328) and later his ideological follower Mohammad Ibn Abd-al-Wahhab (founder of wahhabi sect in 1744) launched a passionate and uncompromising attack on Greek logic. There were defenders as well like Ibn Hazm who maintained a literalist view of Islamic law, but did not openly attack Greek tradition. The other was al-Kindi (870 AD), an Arab aristocrat, who supported the Greek scientific tradition which in his time was identified mainly with non-Muslims

and non-Arabs. Though the rational sciences remained for a while but at the end they lost specially after the conquest and destruction of Baghdad by the Mongols (1258AD). Medicine along with other sciences was soon to be forgotten and once again magic, superstition and prayers with rudimentary medicine replaced the brilliant scientific traditions. Magicians, sooth-sawyers, exorcists and self-trained herbalists replaced qualified and trained medical practitioners and the concept of hospitals faded from the memory. Religious leaders fiercely opposed anatomy and no new knowledge emerged till the advent of modern medicine and importation of European medical knowledge into the Muslim countries in the 19th century (11, 15-17).

The second half of the 19th century is the beginning of major political and ideological transformations in Iran and the start of modernization processes. Modern sciences and western ideas of democracy civil society enlightenment human rights and emancipation of women were introduced through translation of European texts into Persian. The Armenians of Isfahan for their exclusive use imported the first printing machine in 1641. However the first printing machine in Persian started work in Tabriz in 1813 and the book industry was changed forever. The first modern school Dar ul Fonoun (the Institute of technology) started work in 1851 with a few European instructors and texts were translated from a number of European languages to introduce Iranian pupils to modern sciences. Educated Iranians joined and in no time tens of books in Geography, Engineering, Medicine, Military, Biology, Mathematics and other disciplines were translated. In 1925, there were only 253 general practitioners who were trained in Dar-ul-Funoon college of medicine and 652 Hakims who had gained experience of medicine, and were practicing throughout the country. The modernization movement resulted in the constitutional revolution (1906). Iranian students were sent to Europe with government sponsorship and the first modern doctors were educated in Europe. For the first time since Sassanian period a major University with different faculties was built. In 1934 a new legislation was passed and a budget was allocated to build the first University in Tehran. The medical School at Tehran was the first faculty and soon more modern universities followed in other parts of the country. In 1936 for the first time 12 women were admitted into Tehran University. They entered all faculties, included was Dr. Frough Kia who later joined the faculty of medicine. The medical schools were built on European models and staffed with qualified educated practitioners and physicians. Nursing schools were followed and new modern hospitals built throughout the country. In the 1970's foreign doctors were employed mainly from India and were sent into rural clinics. The medical schools at the major universities enjoyed a high standard and graduates of these universities had no problems continuing postgraduate studies in any of the major medical schools in Europe or North America (18).

After the Islamic revolution and establishment of Islamic Republic of Iran by late Imam Khomeini in 1979, the population of Iran had nearly doubled in less than 2 decades, while by the growing spirit of independence inspired by the Iranian government the number of universities and university students increased more than 10 times. For the first time in recent modern history, the Iranian universities started to offer post-graduate specialized degrees in basic, clinical and engineering sciences. All the foreign doctors and medics in rural clinics were replaced by young Iranian medical graduates. More than 800 Ph. D. degrees have been awarded in basic sciences only in the past 10 years (19). Despite the great difficulties that the Iranian scientists have been facing for more than 28 years (as a consequence of a social revolution, 8 years of a destructive war imposed by Iraq, excessive brain drain, discriminatory practices by some international journals in publishing the Iranian articles, and unfair sanctions imposed by the industrialized countries), Iran's science is still thriving and the current number of yearly scientific publications exceeds 2000 (19). When normalized with respect to the number of researchers and the research budget, the Iranian scientists seem to outperform most of their counterparts in the advanced industrialized nations. The main reasons for this are: total engagement in truncated research activities (basic or applied) leading solely to pure publications and the lack of infrastructure for developmental research

activities leading to new technologies. The average impact factor of the papers in various fields of basic sciences seems quite satisfactory, considering the difficult conditions the Iranian scientists are working under. Should the research budgets and conditions improve and the unfair sanctions currently imposed by the world politics be eliminated, a far better contribution to the world science can be expected.

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