

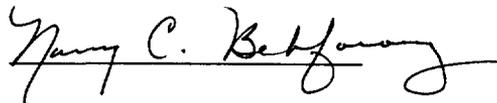
Avicenna's Life and Contributions to Medicine

An Honors Thesis (Honors 499)

by

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A handwritten signature in black ink, reading "Nancy C. Behforouz". The signature is written in a cursive style with a horizontal line underneath the name.

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Abstract

This paper discusses the life of Avicenna, a medieval Middle Eastern scholar. It concentrates on his theories about the human body and his contributions to the field of medicine, even though he made contributions to many different fields. There is also a discussion of the role that his book, The Canon, played in Persia and Europe. Finally, the Middle Eastern and Western views about his life and contributions to medicine are contrasted.

Ali Ibn Sina, or by his Latin name Avicenna, was a well known scholar of the Islamic period that extended from 732-1096. He became known in the Islamic world for his work in almost every academic field ranging from theology to metaphysics, yet he had his most profound effect on the rest of the world in the field of medicine. His book The Canon became used as an encyclopedia of medical knowledge in Iran, and sections of it served as a textbook for many years in European medical schools. Few men that have come after him have had such an effect upon their civilization and its subsequent history (1).

In 980 Avicenna was born in the city of Bukhara, a metropolitan city located in what is today southern Russia. At that time Bukhara was under the control of the Samanid family, who ruled a large empire extending from the Caspian sea through most of modern Iran and into Russia from 875-1005 (1). Avicenna was fortunate to be a citizen of the Samanid empire because of the ruling family's appreciation of knowledge. Under the rule of Amir Jaihani (914-938) the Samanid empire experienced its golden period. This golden period predated Avicenna's life, but it would play an important role in his future academic achievement. Amir Jaihani wrote many books containing detailed maps and information about people from other countries, and he had an immense appreciation for educated men. He went out of his way to make Bukhara an attractive location for the leading scholars of the time in fields ranging from biology to geography. Before long Bukhara acquired the reputation of being the center of learning for the Islamic world (1). Since

there were so many scholars in Bukhara, it also had one of the largest libraries of the period. The Bukhara library was stocked with books that were translated into Persian about medicine and the use of different kinds of drugs (1). Bukhara's wealth of readily available information would set the stage for Avicenna's thirst for knowledge.

Avicenna's father served as a Samanid governor of Karmaytan, a town near Bukhara. Because of his father's position Avicenna had access to all of the top teachers and exclusive schools. He used this privilege to study under Nateli, one of the greatest teachers of the period, until he decided to focus on the field of medicine. Then he studied under the physicians Abu Mansur Qomri and Abu Sahl Masihi (1). Avicenna's training as a physician was very similar to the medical training of today, except that the study of medicine began at a younger age. When Avicenna was in his early teens, he spent each day following a physician around the hospital and then each evening listening to professors give lectures on the theories behind medicine. He even started treating patients for free just so he could learn more about the diseased state of the human body (2). After each student finished his study of medicine, he was required to take an exam before starting to practice. It is not known how strictly this exam was enforced or what the content was, but it served as a means of ensuring each new physician had a certain degree of competence (2). Avicenna began to practice medicine professionally at the age of seventeen under Samanid Nuh b. Mansur, and due to his drive and thirst for knowledge, he was well schooled in the Greek sciences by the time he was eighteen. Avicenna's

career as a physician did not really start until the Amir of Bukhara became ill. None of the established physicians could find a cure for the Amir. Finally in desperation, Avicenna and the other lesser known physicians were allowed to treat him. Avicenna succeeded in curing him and was given full access to the royal library as a reward (2). Through the use of the royal library he was able to expand his knowledge about the human body and its diseases.

A few years later two separate events, the death of his father and the decline of the Samanid empire, led Avicenna to leave Bukhara at the age of 19. This started a new chapter in Avicenna's life of constant movement and instability. Throughout the rest of his lifetime he lived in five different cities, and he used his skills as a physician to gain acceptance into each city's ruling family. At the age of 34, he arrived in Ray in 1014 and gained favor with the ruling family by treating the heir to the throne, Majd-al-dawla, for black bile disease (3). After he cured the heir, he was welcomed to stay and make his life there, but Ray was attacked only one year later and the ruling family was overthrown. This forced him to begin traveling yet again. He finally found rest in Isfahan, where he remained for thirteen years until his death in 1037 (1).

As Avicenna traveled from city to city he wrote over one hundred books ranging in subject from music, astrology, logic and medicine to even different kinds of wine (4). The one book that Avicenna's life has come to be known by is The Canon. He started The Canon when he lived in Jorjan at the age of 32 in 1012, and he finally finished it in 1014

in Ray. It is a compilation of all that was known about Greek and Islamic medicine up to that point, and it addressed Avicenna's views on the debate between Galenic and Aristotelian medicine. It was revolutionary because no one had tried to organize all of that knowledge into one book before.

The Canon was divided into four books and contained over one million words (5). Each book was then further subdivided into a fen. Book one is divided into four fen and opens with the principles of physiology. From there it moves on to the basic principles of medicine. Book two consists of a list of alphabetically arranged drugs, their properties, and their uses. Book three is the largest book and is made up of 21 fen. It gives a comprehensive look at the diseases of the major organ systems moving from head to toe and their treatment. Book four is divided into seven fen and looks at diseases that affect the whole body or occur in any part of it (5). The books of The Canon contain a wealth of well organized information.

The Canon opens with a statement of what Avicenna believed to be the purpose of medicine: "Medicine is a science by which we learn about the conditions of the human body in health and in the absence of health, in order to maintain health or to restore it." (6). Avicenna believed that a physician's only purpose was to concern himself with the different states of the human body. He strongly believed that a physician had no use for the philosophy behind how or why things in the natural world occurred. He also used the opening statement to establish that medicine was indeed a science. Some people

questioned whether the practical side to medicine was a true science if its only purpose was to solve problems and not to theorize about philosophical dilemmas (6). Medicine was also plagued with a lot of untrained charlatans that went around praying on the superstitions of the uneducated in order to make money (2). Thus, the question of whether the practice of medicine was a science was under heated debate. Avicenna tried to settle the debate by clearly stating in the first few pages of The Canon that medicine was indeed a science even though it did not concern itself with the question of why the world worked.

Avicenna then went on to address what the human body was made of and how it became diseased. He believed that everything in the world, including the human body, was made up of a mixture of the four basic elements: earth, water, air, and fire. The earth and water served as the two heavy elements and aided in the formation of matter, while the air and fire served as the two light elements and contributed to the motion of matter or its spirit (5). Each element then performed a specific function in the human body. Fire helped in the process of maturation, air helped in rarefying and elevating substances, earth preserved shapes, and water received shapes (5). Therefore a table, dog, or human each contained its own unique mixture of earth, water, air, and fire.

He also presented the Galenic idea that the body consisted of four humors: blood, phlegm, yellow bile, and black bile. The humors served as sites for the conversion of nutrients and could be classified as being good or bad (5). The mixture and ratio of these

four humors determined each person's temperament (6). He thought that diseases were caused by an imbalance of the four elementary qualities, or by the faulty composition of the body, or by trauma to the body (5). If the disease was caused by an imbalance of the four elementary qualities of hot, cold, dry, and wet, then the cause of the imbalance could be traced to either the patient's environment, regimen, or psychology. He believed that a regimen imbalance could have been brought on by a disturbance in the patient's ratio of sleep to awake, motion to rest, or food to drink (5). Therefore if a patient was not getting enough sleep or was getting too much sleep it would cause a disturbance in the natural balance of hot, cold, wet, and dry in the person's body. This would then lead the person to feel ill and be in a diseased state.

Avicenna also believed that not only was a person's body as a whole made up of hot, cold, dry, and wet, but that each organ system was also made up of its own mixture of these four qualities, this mixture was called complexion. The complexion of each part of the body was compared to the palm of the hand because the palm was considered to be the most temperate area of the body (5). He composed four lists comparing each part of the body's complexion to that of the palm. Each list started with the extremes for hot, cold, wet, or dry and worked its way down to the temperate complexion of the palm. A physician was then able to diagnose a disease by comparing the complexion of the diseased part of the body to that of the palm and then comparing that to the list.

Avicenna also believed that the complexion of a person was sex linked and changed as

the person aged. He thought that as a person grew older their heat dissipated, therefore children and youths were hotter than adults. This served as an explanation for death; as a human aged his or her heat grew less and less until death occurred.

In The Canon Avicenna also touched on the debate that was occurring between the group that followed Galen and the opposing group that followed Aristotle over the functions of the brain and heart. Even though most of Avicenna's medical practices mimicked those of Galen's, he strongly believed in Aristotle's philosophy of how the body and natural world was organized. In his book he sided with Galen on the practical side of medicine, yet he rebuked Galen's interest in the theoretical side of medicine and championed Aristotle's theories. The followers of Aristotle believed that the heart served as the center of the body's soul and was the organizing center for its functions. They believed that nerves, blood vessels (Aristotle did not make a differentiation between arteries and veins), and movements all originated in the heart (6). The followers of Galen on the other hand believed in the triad of primary organs. They thought that the heart, brain, and liver served as the primary organs of the body. The brain served as the origin of all the nerves, the heart was the origin of all of the arteries, and the liver was the origin of all the veins and served as the site of digestion (6). Avicenna knew that because of the advances in anatomy that had occurred since Aristotle's time he could not disprove Galen's claims, yet he did not want to disprove Aristotle. He, therefore, agreed with Galen that the primary organs formed a triad, but he argued that when a fetus was

developing, the heart served as the first organ to form and had to be the primary site of control for the formation of all subsequent tissues and organs (6).

Another commonly debated topic between the followers of Galen and Aristotle was the exact anatomy of the heart. It was commonly believed that the circulatory system was divided into two. The arteries originated in the heart and got smaller in size as they moved towards the periphery of the body, and the veins originated in the liver and decreased in size as they moved towards the periphery of the body also. The blood flowed in the arteries and veins in a “centerfugal manner” (sic). The flow decreased in volume as it moved away from its two starting points because it was a nourishment, and it was used up by the body (2). It was also generally believed that all the blood eventually had to move through the heart and lungs. The controversy arose over the pulmonary vessels and how the blood moved from the right side of the heart to the left side. Avicenna believed that there had to be some kind of visible connection between the two sides of the heart. He argued that if anatomists looked hard enough they would eventually find the elusive connection (2). He also thought that since the pulmonary vessels were double they had two functions. The first function was to move blood to the heart and lungs for nourishment. The second function was to move blood to the lungs for aeration (2). It took another three hundred years before Avicenna was proven wrong, and it was realized that the only function of the pulmonary vessels is to move blood to the lungs for gas exchange and then back to the heart.

Another area in which Galen and Aristotle sharply differed was in the area of conception. Galen argued that both the female and the male contributed “semen” to the child because the child resembled both parents (5, 6). Aristotle on the other hand thought that only the male contributed “semen” to the child and was the sole carrier of the spirit of the fetus. The female served only a passive role in the conception of the child and was the carrier of the male’s spirit (5,6). In this debate Avicenna sided with Galen and wrote that the male and female each equally contributed to the formation of a baby. The male contributed semen from his testicles and the female contributed “semen” from her ovaries. This finally laid to rest Aristotle’s idea of reproduction.

In The Canon Avicenna addressed many theories behind medicine, but he also characterized the symptoms of many different diseases. For hundreds of years it was believed that small pox and measles were the same, therefore no distinction was made between the two. Rhazes, another great physician of the Islamic period, was the first person that characterized measles as a separate disease. Soon after, Avicenna backed up Rhazes’ observation when he wrote:

Know, then, that measles is a bilious small-pox. In most respects there is no difference between them, save only that measles is derived from the bilious humor. And again, the rash of measles is smaller, does not penetrate the skin, is not appreciably elevated, at least not in the beginning, whereas the rash of small-pox at the onset is appreciable to the touch and

is elevated. The individual spot of measles is smaller than that of small-pox and less rarely erupts on the eye. The physical signs of measles are nearly the same as those of small-pox, but the nausea is greater, the mental disturbance and inflammation is more severe, though the pains in the back are less. The rash of measles usually appears all at once, but the rash of small-pox spot after spot (2).

Avicenna not only lent credibility to new theories, but he also made some important contributions of his own. He was the first person to characterize the symptoms of meningitis and anthrax in The Canon, and it was his meticulous attention to putting the details of almost every disease known at the time in to one book that greatly served to organize the practice of medicine (7).

In Avicenna's lifetime little ground was broken in the field of surgery because of the lack of knowledge about the inner workings of the human body, the spread of infection, and anesthetics. Both the Islamic and Christian church had an edict against post-mortem examinations, so it was hard for physicians to really understand how the inside of the human body was put together (4). Most of the knowledge that surgeons and anatomists did have came from working with animals. There was also very little known about preventing contamination and disease once the patient had been operated upon. To try and deal with the spread of infection, Avicenna came up the practice of pouring wine, which contains alcohol, on the open wound (7). This was an advance in the prevention of

contamination, but the chance of obtaining a secondary infection during surgery was still very high. Therefore surgery was avoided as long as possible and used only in cases where nothing else would work. If an extreme case absolutely required surgery, then the physician had to decide what to use as an anesthetic. In The Canon, Avicenna suggested the use of sweet-smelling moss added to wine if it was desirable to get the person unconscious quickly. If a deep state of unconsciousness was needed, then he recommended the use of darnel water mixed with wine or opium. He also added that black hyoscyamus could be boiled with mandragora bark until it became red and then added to wine (4). The whole surgical process was rudimentary at best, yet with all of these obstacles some surprisingly modern surgeries did successfully occur.

If a patient was in an advanced stage of cancer, then Avicenna believed that surgery was the only treatment that gave the patient any chance for survival. He taught surgeons to make a wide and bold excision, followed by the removal of the tumor. Next all of the veins that ran into the tumor were also removed and the area was cauterized (2). In order to sew the patient back up after surgery most physicians used thread, cotton, or silk to make the suture, but Avicenna championed the use of pig bristles because he believed they were less likely to cause an infection (2). If the patient survived the surgery, it was still not guaranteed that the cancer would never return. Avicenna wrote about a woman who had one of her breast's removed, but a few months later he found another tumor in her other breast (2). His treatment of cancer is very close to some of our modern

day techniques, but due to the lack of technology of the time period the survival rate of the patient was much lower. It is amazing that under such primitive conditions physicians were performing procedures like mastectomies in order to save lives.

Avicenna realized that surgery was sometimes needed, but he tried very hard to find other non invasive ways of treating a problem before surgery was performed. If some kind of obstacle caused a closing of the urethra, most physicians made an incision into the urethra and then removed the obstacle, or they inserted a small tube proximal to the stricture (4). These processes were both invasive and carried a significant risk. Avicenna believed in placing a reed in the urethra and blowing down it in order to remove the obstacle. This procedure didn't expose the patient to as many secondary risks, and it was also utilized by Avicenna to cause an undescended testicle to descend (2).

The medieval physicians of the Middle East were surprisingly frank about sex, they were more open about sex than most of the Middle East is today (2). Avicenna wrote freely about the sexual drive of humans and discussed in detail the physical changes that occurred in the human body during sex. Sex was treated as a natural part of daily life, and all physicians became skilled in gynecology. In The Canon Avicenna spent a whole chapter discussing pregnancy. This was a departure from the long held belief that only midwives should deliver babies. He discussed how to induce labor by the use of drugs or instruments, and he also discussed how to manage difficult pregnancies (2). Since midwives were not skilled enough to read and understand The Canon, physicians must

have helped with the delivery of some children.

Avicenna's book, The Canon, exerted considerable influence on his peers, but it did not really influence Europe until the thirteenth century, about two hundred years after it was written. Michael Scot began translating Arabic books into Latin around 1285, but his translations were basically ignored (2). In the mid-thirteenth century and the early fourteenth century a growing number of translated Greek and Arabic books became available in Europe. Due to this, interest in Greek thought and medicine greatly increased. Since a lot of Arabic medical theories were built on Greek theories, interest in Arabic works also increased. The Canon was first introduced to European schools in Toledo, Italy. Toledo was not a school famed for its medical curriculum, but it did have a large collection of Arabic translations (5). After this initial introduction of The Canon to a European medical school, the book began to gain momentum and acceptance among a wider circle of universities and educated people.

In the beginning of the 1200's Ricardus Anglicus became the first documented person to teach Avicenna's theories to his students. In his book Anatomia vivorum he incorporated passages from The Canon and commented on them (5). Other scholars quickly followed and began incorporating some of Avicenna's ideas into their writing. Avicenna's principles soon began to accumulate a lot of written support and criticism. Following this exposure of Avicenna's theories, medical schools began to adopt his books for their classes. By the middle of the thirteenth century Avicenna had become an

indispensable part of medical and surgical teachings. The Canon became so widely accepted that it was used as a source for the formation of encyclopedias, and even monasteries overlooked the difference in Avicenna's religion and used his book to treat their sick (5).

Avicenna's books also generated considerable interest outside of the traditional European academic setting. His book, The Canon, was an essential part of every professional man's home library. His influence grew so great that the vernacular from his books was used in everyday settings. He even exerted a major influence in medieval Jewish medical culture (5). Jews were excluded from traditional European medical schools because of their religion, so they were forced to turn to non-European sources for their medical knowledge. Their main source became Avicenna.

With all of these other uses, The Canon's main purpose still remained its use in the European medical schools, especially those of Italy. The universities of Montpellier and Bologna were especially known for their in depth teachings of Avicenna's ideas (2). Every university had a copy of The Canon in its entirety, but very rarely did a school use the entire book as a textbook. Just the magnitude of it would prevent the whole book from being used (5). Instead sections of it were utilized to teach the students both the theory behind medicine and medicine's practical application. The theory, found in book one of The Canon, taught students about the general principles behind a specific diagnosis or treatment (5). The practical application of medicine, found in books one, three, and four,

was the most widely taught of the two branches. It was used to teach students exactly how to diagnose and treat a patient with certain symptoms (5). This division of The Canon into a practical and theoretical side eventually caused a distinct split in the curriculum of medical schools. Some medical school became centered on the theory of medicine, while a majority of other medical schools became centered on the practical side to medicine.

In addition to the general use of The Canon as a textbook, the University of Bologna in 1405 made a four year rotation of classes based around the practical side of Avicenna's teachings. In the third book of The Canon Avicenna described the symptoms and treatments of diseases moving from head to toe, therefore the Bologna method of teaching medicine was to divide each year into the study of the diseases of a certain section of the body. The first year was spent on the head and brain. The second year was devoted to the lungs, heart, and thoracic cavity. The third year was spent studying the liver, stomach, and intestines, and the fourth year was dedicated to the study of the urinary and reproductive systems (5). Bologna was different from most other medical schools because its curriculum was based solely around one book, The Canon.

In most medical schools The Canon was not the only source of knowledge, but it was used as part of an integrated system that used other translated Arabic and Greek books. This time period, therefore, also saw a resurgence in the support of both Galen and Aristotle as well as Avicenna. It was the supporters of the two Greeks that would

eventually lead to the downfall of Avicenna's support and acceptance (2).

As more and more people came to accept and champion Greek thought, criticism of the Arabs increased. People began to believe that the Arabs had been misrepresenting Greek ideas (2). This caused a split of the medical schools into four distinct groups. One group was the Arabists; these people tried to find ways to support the works of Avicenna and other Middle Eastern physicians. Directly opposed to them were the Humanists, who wanted to turn back the clock past the Arabs and directly follow the teachings of the Greeks. Another group was called the Conciliators, and they tried to find the middle ground between the two extremes. Finally, there were the Experimenters, this group didn't follow the Greeks or the Arabs and wanted to move medicine forward without looking back (2). Eventually the Experimenters would win the battle and reorganize medicine.

In the 1500's opposition to the Arabs grew greater. Paracelsus lead a group of followers in a public burning of The Canon (2). He did this to protest the use of the book in any medical school, he also referred to Arabs as liars (2). By the 1600's Arabic medicine had become branded as that of charlatans and quacks (2). With all of this growing distrust of Arabic ideas, the use of Avicenna's book quickly declined until it was almost totally out of circulation, yet it did survive in a few places. The University of Brussels continued to lecture about Avicenna until 1909 (2). In general, the ideas of both Avicenna and the Greeks had become dated. It didn't take long before the

Experimentalists began to discover new principles in medicine. This made the ideas of medieval physicians obsolete and finally closed the door on all of Avicenna's medical theories.

Even though this paper concentrated on Avicenna's contributions to medicine, he was not solely a physician. He also made many contributions to other parts of Persian civilization, especially theology. The Canon was Avicenna's most recognized book, but it was not the only revolutionary book that he wrote. He also wrote Kitab Ashshifa, the largest book of its kind ever written by one man. In it he discussed logic, natural science, psychology, theology, geometry, astronomy, arithmetic, music, and metaphysics (8). The most lasting affect that the Kitab Ashshifa had on Persian civilization occurred in the field of theology. In the medieval Middle East, Muslims were not encouraged to study the reasons behind the everyday actions of their religion, but Avicenna disagreed with this approach, so he became one of the first theologians to study the theories of Islam (8). All of his theological concepts rested on the theory that God is a necessary existent, and that there is a gradual multiplication of beings through emanation from God (8). This made him very unpopular with the established Islamic leaders, but they could not find a way to stop him. Avicenna became one of the theologians that started the movement towards the understanding of mystical theosophy that would mark the direction that Islamic philosophy would follow in the future, especially in Persia (8).

I found the research of this topic to be fascinating. The more research I did the

more I began to notice an interesting trend in the books that I read. Each book characterized Avicenna in one of two ways. Either the author exalted him as a genius and a great physician, or the author downplayed his contributions to medicine. This was strange because I was reading two totally different accounts of the same person. On closer inspection, I believe that the differences in the attitudes of the authors to Avicenna had a lot to do with the author's own ideas and beliefs about the Middle East. If the author was of Middle Eastern descent, then he or she spoke of Avicenna in glowing terms. If, on the other hand, the author was not of Middle Eastern descent, then he or she was not as positive about Avicenna.

In The History of Medicine, Fielding Garrison (1870-1935) presented a very unflattering picture of Avicenna. He downplayed all of Avicenna's contributions to medicine by writing, "... the influence of The Canon upon medieval medicine was bad in that it confirmed physicians in the pernicious idea that ratiocination is better than first-hand investigation. It also set back the progress of surgery...". (9). He even wrote that Avicenna stupefied European physicians with his scribbling. Garrison did not stop at insulting Avicenna academically, he personally characterized Avicenna as, "...one who trod the primrose path at ease and died in the prime of life from the effect of its pleasures..." (9). Next Garrison attacked the whole Islamic period by characterizing it as, "...tending towards the destruction and persecution of things of the mind..." (9). Overall, Garrison did not have a very good impression of Avicenna as a person or a physician. He

even disliked the whole Islamic period. I believe that Garrison's portrayal was influenced by his job as a Lieutenant-Colonel, his membership in the US Medical Corp, and the time period that the book was written in (1921). His description of Avicenna and the Middle East is in stark contrast to that of Cyril Elgood's.

In A Medical History of Persia which was written in 1951, Cyril Elgood's portrayal of Avicenna was extremely positive. In contrast to Garrison's negative summarization of Avicenna's contributions to medicine, Elgood wrote that The Canon was, "...a great work that was the result of careful examination and much thought..." (2). Elgood's description of Avicenna's life was also very different from Garrison's. Elgood wrote, "...At this point there walks into the story one of the greatest men that this world has ever seen... He was the son of a middle class tax collector...who started with none of the advantages of life...yet became one of its leading citizens..." (2). Elgood specifically stated that Avicenna started out with no advantages, while Garrison said that Avicenna led a privileged life. These two authors each described Avicenna very differently. Once again, I believe that Elgood's view of Avicenna was influenced by his years spent in Teheran, Iran working as a physician.

The differences between Garrison and Elgood were just a few that I found while researching Avicenna's life. His theories elicited strong opinions from both those that supported him and those that were critical of him. This response has been the same since The Canon was introduced to Europe. One of the reasons for this difference might be that

it is very difficult to find an actual copy of The Canon, especially one that has been translated into English, therefore most of what is known about the book is second hand information. The same can be said about Avicenna's life. Even though an autobiography about his life does exist, it is debatable whether he actually wrote it himself. The autobiography is also very vague and mainly discusses his achievements (5). As long as no solid first hand information can be found about Avicenna, then his life and the amount of influence he exerted on the future of medicine is left open to the interpretation of each person.

No matter what one believes about Avicenna, one can not deny that his life has left a mark on Middle Eastern history. His theories not only in medicine, but also in philosophy helped shape the future civilization of Persia. Furthermore his book, The Canon, circulated around the world and for many years served as one of the primary textbooks of all medical students. His theories and ideas are well known, but Avicenna as a person still remains a mystery. Little is known about the type of person he was and what he felt, therefore all that anyone is left to examine his life by is his surviving books. Whether one believes that Avicenna was a genius or just a person that recycled Greek ideas, it can not be denied that he influenced the future of medicine.

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