The curriculum and education of medicine after Galen in Alexandria, Egypt

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ABSTRACT

توجد في مصادر التاريخ الطبي الإسلامي للعصور الوسطى معلومات غنية عن ترجمات كتب مدرسة الإسكندرية الطبية وسير ذاتية للأطباء. وكانت كتب جالينوس تأتي في المرتبة الأولى من الكتب التي درست في مدرسة الإسكندرية الطبية. لخصت مدرسة الإسكندرية الطبية 16 كتابا لجالينوس وكونت منها مدونة تدرس في سبعة مراحل وتسمى هذه المدونة بجوامع الإسكنريين. حيث أخرج حنين بن إسحق وهو من المترجمين المشهورين قائمة ببليوغرافية عن أعمال جاليوس. وتشير نتائج بحثنا هذه بأن هذه المدونة التي كونت في آخر عهود مدرسة الإسكندرية الطبية قد حصل عليها المسلمون بشكل سليم وكانت تدرس بنفس التقاليد القديمة لمدرسة الإسكندرية الطبية.

In the medieval history of Islamic medicine sources, there is a lot of information regarding the translation of the books on the Alexandria Medical School and regarding the bibliographies of doctors. Among the books that were taught in Alexandria Medical School, Galen's works are the most important. One of the famous translators, Hunayn ibn Ishaq, has made a full bibliographic list of Galen's works. Galen's corpus consisted of 16 books in summary. This corpus is called "*Jawami al-Iskandaraniyyin*". These books consisted of 7 training stages. The data on our research show that this corpus that was brought together during the last period of the Alexandria Medical School has been passed on to the Muslims as a whole, and has continued to be taught in a way according to the old traditions.

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The famous School of Alexandria was founded in approximately 300 BC, and it became the foremost teaching center of medical education. Its 2 founders and best medical teachers were Herophilus, known as the first anatomist in history, and Erasistratus, whom some regard as the founder of physiology.[1,2] In the later period of the School of Alexandria, the medical works of Galen were based on the recognized authority, and a selection of his books formed the official curriculum for medical study.[3] Galen was born in Pergamon in Asia Minor in the year 131 AD (**Figure 1**). After receiving medical training in Smyrna and Alexandria, he gained fame as a surgeon to the gladiators of Pergamon. He was called to Rome to be the physician of the Emperor Marcus Aurelius. Galen spent the rest of his life writing an enormous corpus of medical works until his death in 200 AD. A supporter of observation and reasoning, he was one of the first experimental physiologists, researching the muscles, heart, spinal cord, and urinary system in controlled experiments. He proved that the arteries are full of blood. His anatomical reports were based mainly on the dissection of monkeys and pigs. Galen's works came to symbolize Greek medicine to the medical scholars of Europe and the Middle East for the next centuries.[4-6]

Medicine in the medieval Islamic world started with the translation of the books of Greek, Persian and Indian physicians, and kept on its development through its own experience and background. Jundishapur Medical School was a renowned cosmopolitan institution and had a crucial impact upon the further development of Islamic medicine.[7] It was established during the Shapur II reign (309-379 AD) and was a flourishing center in the fifth century AD. In the seventh century AD, (at the time of Islamic conquests), the school was regarded

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as the most important medical center of the ancient world. At this medical school, the Hippocratic and the Galen traditions, together with the rich Persian and Indian medical heritage were combined, developed, and subsequently transformed to the Islamic world.[8]

The most significant of the translations were both Hippocrates and Galen's books and the translation of commentaries and abridgments by Alexandrian physicians. Huneyn-Ibn-Ishaq (808-873 AD) known as Johannitus, was born in Al-Hira in Iraq and studied medicine at the Jundishapur School, and then in Alexandria. Hunain took possession of the Galen's corpus in the Abbasid period (ninth century). He personally took part in activities of translation and made a bibliographic full list of Galen's works. Hunayn Ibn Ishaq worked out an extensive bibliography including Galen's works that were lost, translated, and not translated into Arabic yet, and translated into Syriac and other languages. Hubeysh bin Asam also translated it into Arabic.[9-13]

In the famous encyclopedia of medical history "*Uyunul-Anba Fi-Tabaqat AI-Atibaa*" (The sources of the knowledge of classes of doctors), Ibn Abi-Usaybia allocated a separate chapter for the Alexandrian physicians. In this chapter, he gave the biography of the last physician of the Alexandrian period, and he gave lengthy relations from the book, " *Kitab al-Nafi fi Kifayat Ta`alum Sina`ah al-Tibb*" (Useful book on the quality of medical education)" by Abu al-Hasan Ali Ibn Ridwan, who was a famous physician of Bagdad. He also explained which method was used, and which sequence was followed in accordance with Galen's works, as textbooks in the Alexandrian Medical School after Galen's period.[9,10] In each grade of the Alexandrian Medical School, which had a 7 grade training system, it can be seen through these relations, which method was applied in teaching any of Galen's books to Alexandrian physicians. The students had to memorize all these books.[10-12]

Details of the medical training system. After Galen, 7 Christian physicians compiled a corpus of 16 books by summarizing Galen's books and commenting on them. This corpus is called "*Jawami al-Iskandaraniyyin*".[9] These books, which consisted of 7 training stages were arranged so the students would be interested, and memorize them fast. The names of those physicians were Istafon; Gasiyus; Teodosiyus; Enkilavus; Ekilavus; Flariyus; and Yahya an-Nahvi. Enkilavus was the eldest. It was also Enkilavus who first classified those books in 16 chapters. Abu-l-Hasan al-Mukhtar ibn al-Hasan ibn Butlan (Latin name: *Elluchasem Elimither*, 1066 AD) who was a famous Christian physician born in Harran, and later trained in Baghdad, the capital of Abbasids, gives us this information:[9, 13-15]

"During the medical training in Alexandria, Galen's books were abridged by the physicians who used Galen's books as textbooks and trained the physicians in Alexandrian medical schools. The medics would read and try everyday, to seize up those books, which were followed in a certain order. Then forming selected simpler new sentences, they reduced them to booklets so that they could be memorized easily. Later on each of those 16 texts turned into separate books. The best of the commentaries ever obtained is Gasiusus's commentary".[9]

Of all the aforementioned Alexandrian physicians, Yahya an-Nahvi lived up to the Islamic period. Information on him can be found even in the Islamic sources. Yahya an-Nahvi was a savant and clergyman in a church in Egypt. According to Ibn Ridwan, the medical curriculum of the School of Alexandria in the sixth and seventh centuries was designed in the following way:[9]

Medical curriculum of Alexandria School (between sixth and seventh century AD). I. Introductory courses. 1. Optional subjects: Language and grammar; 2. Compulsory subjects: Logic, physics, arithmetic, numerals, measurement, geometry, the compounding

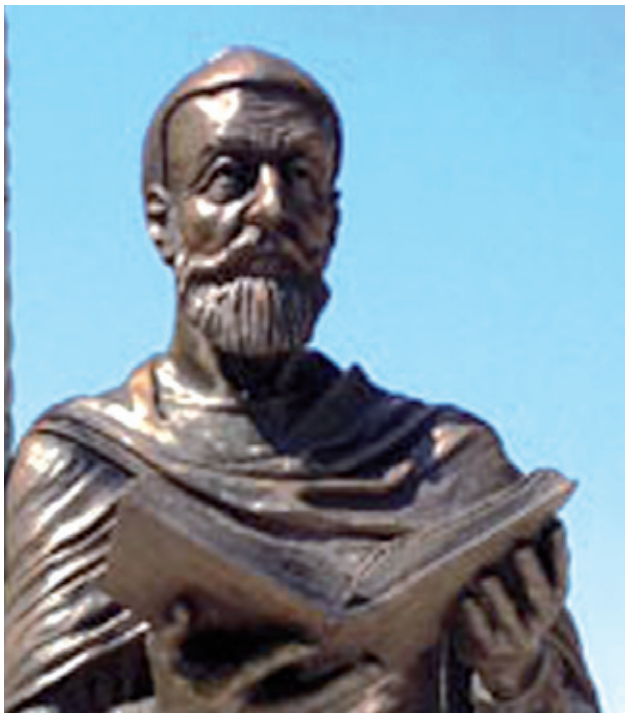

Figure 1 - A picture of sculpture made in memory of Galen in Bergama (Pergamon), Turkey.

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of drugs, astrology, and ethics. Some of the textbooks followed in these lessons: Arithmetica: Euclid's "Elements of Geometry", Prolemy's "Manuel Tables", and Prolemy's "Tetrabiblos", for books on the compounding of drugs: refer to Galen's "On the method of healing", "On materia medica", "On compounding of drugs according to genera", "On the compounding of drugs according to affected places".

II. Main courses. 1. Logic. The textbooks followed: Aristotle's Categories, *De Interpretatione, Syllogism, and Demonstration*. 2. Medicine. In this part, books of 2 important physicians attract attention. (a) Hippocrates' "Aphorisms"; "Prognostic"; "Regimen in Acute Diseases"; "Airs, Waters and Places". (b) Sixteen of Galen's books are to be studied in 7 consecutive grades: Abu al-Hasan Ali Ibn Ridwan gives us this information regarding the medical training in Alexandria in his book "*Kitab al-Nafi fi Kifayat Ta`alum Sina`ah al-Tibb*" (Useful book on the quality of medical education)

"*The fact that Galen's books had been arranged in 16 booklets made them easier to read and memorize for those who dealt with medicine, aroused desire and enthusiasm for those who wanted to learn medicine, and promoted medical training. Therefore, those who read those books have seen Galen's interesting discoveries and commentaries on medicine aspired to medical profession. Having examined other books on medicine, they drew up a 7 grade medical training curriculum consisting of Galen's books*".[9,16]

Grade I. (Introductory course) The person who attended to this grade would learn some ordinary information on medicine and its application. The student who succeeded in completing this part was entitled to proceed to the next grade; otherwise, he would not be given any information regarding medication and their characteristics.[9] In the introductory course, 4 books were followed as textbooks:

a) "Kitab al-Fark" (on sects). This book was brought out as one chapter, and deals with the characteristics of drugs and their combinations according to views acquired through experience. It comments not only on the data gathered by the scientist who used comparative methods in their studies, but also on their methods of application. When a difference was found between experience and comparative methods, it was re-studied and re-evaluated, and a decision was taken in accordance with more convenient method.

b) "Kitab al- Sina'atu's-Sagir" (on the art of physic). This book consists of only one chapter, and it contains all theoretic and practical aspects of medicine.

c) "Kitab al Nabz al-Sagir" (on the pulse). This book consists of only one chapter, and it deals with pulse and clues of heart disease. The books provide fairly useful information regarding the subject.

d) "Kitab al-Baglugan" (on therapy). This book consists of 2 chapters. In the first chapter, it accentuates the importance of being cautious and logical in order to get well. The student who has learned the necessary minimum medical practices must know, which food and drugs he should use. The second chapter is concerned with some subjects related to the necessary practices of the medical profession. These 4 books, which were used as textbooks in the first grade are enough for the students to get the necessary medical training.

Grade II. In the second grade, the aim was that the students be acquainted with the elements and human temperament and organs, and that they should be taught the way organs work. In the second grade, 4 books were used as textbooks:

a)"Kitab al-Ustuksat" (on the elements according to Hippocrates). The book provides information on the rapid alterations in the human body and all the elements it needs, and the tendency of these towards transformation. Galen deals with the humoral theory here as well.

b)"Kitab al- Mizaj" (on temperament). This book consists of 3 chapters, and it deals with temperament: How each temperament emerges and what kind of clues it gives when it emerges.

c)"Kitab al-Quva at-Tabiiyya" (on the natural faculties). This book consists of 3 chapters, and it deals with the natural powers that control the natural conditions of human body, its causes, and the signs showing them.

d)"Kitab at-Tashrih as-Sagir" (on minor anatomy). This work consists of 5 chapters. Each chapter was designed and written by Galen himself. Later on, the Alexandrine physicians made these chapters into a separate book. Similar organs and their numbers are dealt in this book. The books in the second grade explained all the natural functions of the body; explaining the natural balance of the body. The person who studies them could learn everything needed regarding the structure of the body.[9,17]

Grade III. The third grade consists of a single book including 6 chapters. "*Kitabu'l-ilel ve al-Araz*" (diseases and symptoms). This book deals with the reasons and symptoms of diseases. This chapter is an important source with regard to the medical profession for the physicians, who used the comparative method in their studies. It is said that once a medical student had learned and well understood and what is explained

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in this book, there will be nothing left hidden and unknown regarding the medical profession for him.[9]

Grade IV. In the fourth grade, 2 books were used as textbooks: on the diagnosis of diseases of the internal organs, and on the pulse.[9]

a)"Kitab ilal al-Aza al-Batina" (on the diagnosis of diseases of internal organs). This book consists of 6 chapters. It deals with the diagnosis of the diseases found in the internal organs. These diseases are the ones that cannot be clearly felt with 5 senses. Therefore, there are some clues in the symptoms of each disease. The book states that, it is certainly possible to detect which disease exists in which organ with the aid of these clues. For example, if a patient with distention somewhere in his chest has symptoms such as fever, cough, and pain it shows that he has an inflammation affecting the pleural space.

b)"Kitab al-Nabd al-Kabir" (on the pulse). The book was designed in 4 chapters each having 4 sub-titles. The first chapter deals with the description of the heart, and the second chapter deals with the hearts chambers and valves in detail, and explains the functions of the heart. The third chapter is on the pulse. The fourth chapter gives us fairly useful information both on the ways the symptoms and effects of the diseases are detected, and its relation with the power of the body.

Grade V. The fifth grade consists of 3 books. a)"*Kitab al-Hummayat*" (on the types of fevers). b)"*Kitab al-Buhran*" (on crisis) which provides information on the periods of diseases, so that the patient may receive appropriate treatment during each period. c)"*Kitab Ayyam al-Buhran*" (on critical days), deals with the periods of the diseases and the critical days in the course of the disease.[9]

Grade VI. One book is to be studied. In this grade, "*Kitab Hilat al-Bur*" (on the method of healing) was used as the textbook. It consists of 14 chapters. The book explains the subjects on learning the content of the drugs used for each disease, according to the doctors who work with the comparative method. The student who follows this book as a textbook has to look into Galen's book on pharmaceutics, for example "*Katacanis*", "*Meyamir*", "*Ma'cunat*".[9,18,19]

Grade VII. In the seventh grade only one book was used as a textbook. The book followed in this grade was "*Kitab Hifz al Sihha*" (on the method of preservation of health). The book consists of 6 chapters, and was devoted to instructions on the principles of hygiene.[17] 20 books on medicine have been chosen from the works of Hippocrates and Galen so that the students interested in the subject may be encouraged to read more of their works for example: "*Kitab al-agziya*", and "*Kitab al-Riyazat*".

Once the physicians studied these 16 books on medical training summarized by the Alexandrian physicians, they also have to refer to Galen's other books as complementaries. For example, his book "*Fi alat al-shamm*" (on the organ of smell) pertains to the second grade, so it has to be followed in this grade. Likewise, his " *Kitab ilal al-tanaffus*" that deals with respiratory diseases has to be used in the second grade as well. This graded training method is a suitable technique applied specializing in medicine by the Alexandrian physicians. It is possible, through this method to look into Galen's other books.

In the ninth century, the famous Arab historian, and geographer Al-Yaqubi made a condensed summary of the books by Galen used in Alexandria.[11] Ibn Juljul's (933-994 AD) masterpiece on the history of medicine is "*Tabagat al-Atibba: wa-l-Hukama*." The book was arranged with respect to the chronologic order, and the lives of well-known scientists and philosophers from various nations who lived in different ages are told in 9 chapters. In the fifth chapter of his book, the Alexandrian School is dealt with. In this chapter, there is some information on the commentaries and summaries of Galen and the Arabic translations of Galen's works and medical training. He even reports that the old medical training of the Alexandrian School continued in the same way until his time.[11,20] Ibn al-Qifti (1248 AD)'s book on medicine is *Tabakatu'l-Hukama va Asbahi'n-Nujum ve'l-Atibb'a*" and includes not only medical sciences, but also biographies of some 358 scientists, famous in medical science, together with philosophy, logic, mathematics, astronomy, and botany. The book reports that the Alexandrian School sustained the education and training in the traditional methods, and Galen's 16 books were still being followed.[21,22]

The medical training applied by Muslim physicians in Alexandria in the Middle Age was criticized by some physicians, one of whom was Abu al-Faraj Ali ibn al-Husayn ibn Hindu (1020 A.D.) He was a famous philosopher, physician, and pharmacist who lived in Iran. Abu al-Faraj recorded his criticism in his book "*Miftah al-tibb wa-minhaj Al-tullab*" (The key to medicine and a guide for students).[12,22-24] Abu'l-Faraj wrote on the subject: "The booklets "*Jawami al-Iskandaraniyyin*" made up by Alexandrians with the summaries from Galen's books were thought to be the basic texts of Galen's books, whereas they are not the original texts: They are only the writings depending on them.[7] Abu al-Faraj's teacher Abu al-Khayr Ibn Ammar (tenth century), a famous Christian physician who produced valuable works on the primary and secondary subjects of medicine, is also of the opinion that the

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booklets made up by the Alexandrian physicians are not the original forms but the summaries of Galen's books, because these books do not have the same statements, diagnosis, and comments on internal diseases cited in Galen's other books. Also, the order and the arrangement of the books are inaccurate. Galen started medical training with dissection, and went on to study physiology and the movements of human body, and then he came to an end with the subject of diagnosis and treatment.[9,22]

Abu'l-Faraj wrote this: "The fact that the Alexandrians made Galen's books into 16 booklets are not sufficient to complete medical training, and do not include all the goals. Therefore, as the students can never understand complicated parts, the secrets, and the main object by themselves, the teachers' explanations and comments are needed. These texts came into being after the subjects are understood as a result of mutual negotiations,"[25] the Alexandrians prepared not only collections related to Galen's books, but also other collections on medicine and philosophy. Furthermore, Alexandrians formed some commentaries of his books. Pre-Islamic period physicians like Sergius, Masargis, translated those books into Syriac. These collections, prepared by the Alexandrian Christian physicians, were translated into Arabic during the Abbasid period. Abu Bakr Zakariyya ar-Razi (Rhazes) often gives some quotations from these translations in his book "*Kitab al-Hawi fi'tTibb*" (The comprehensives book on medicine).[9,26]

In conclusion, Islamic medicine is the most known aspect of the Islamic civilization, and is regarded both as a well-known motif, and a successful branch of science. Islamic medicine combines the Grecian medicine and the traditions of Hippocrates and Galen, with the theory and practices of the Iranian and Indian civilizations. Therefore, an important feature of the Islamic medicine is for it to synthesize the positive aspects of these significant branches of science.

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