

# A Concise History of Islamic Medicine: An Introduction to the Origins of Medicine in Islamic Civilization, Its Impact on the Evolution of Global Medicine, and Its Place in the Medical World Today

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**How to cite this paper:** Shahpesandy, H., Al-Kubaisy, T., Mohammed-Ali, R., Oladosu, A., Middleton, R. and Saleh, N. (2022) A Concise History of Islamic Medicine: An Introduction to the Origins of Medicine in Islamic Civilization, Its Impact on the Evolution of Global Medicine, and Its Place in the Medical World Today. *International Journal of Clinical Medicine*, 13, 180-197. <https://doi.org/10.4236/ijcm.2022.134015>

**Received:** March 6, 2022

**Accepted:** April 21, 2022

**Published:** April 24, 2022

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## Abstract

The practice of medicine in Muslim nations dates to the millennia before the advent of the religion of Islam. As far as the pre-Islamic period is concerned, what evidence is available indicates the medical evolution began nearly 6000 years ago in Mesopotamia, where medicine for the first time in history became a recognised profession. In ancient Egypt, it was practised by priest-physicians who demonstrated astonishing knowledge in various medical subjects. The origins of medicine in ancient Persia (Afghanistan, Iran, and parts of Central Asia) span the 6<sup>th</sup> century B.C. and to the Zoroastrian religious book of Avesta, which delved into such topics as preventive and clinical medicine. In reference to the account of medicine in the Arab peninsula, limited information exists. In terms of post-Islamic ages, the foundations of Islamic science were laid during the reign of the second Abbasid Caliph, al-Mansur, and the establishment of Baghdad as its capital in 762 A.D., when the Arabic translation movement commenced. During the next six centuries, medicine and other fields of science flourished, and prominent physicians such as the Bukht Yishu family, Rāzī, Majūsī, Avicenna, Jorjānī, Al-Zahrāwī, and other scientists emerged. In both the pre- and post-Islamic ages, Islamic medicine was heavily influenced by Mesopotamian, Egyptian, Persian, Indian, and, predominantly, Greek medicine. Nevertheless, the advancements and innovations in

medical science and healthcare systems that were achieved during the early and medieval Islamic ages have indubitably made an invaluable contribution to the evolution of medicine throughout the world, and to the invention of numerous procedures and practices which are still widely performed today. Hence, the value of comprehending the pivotal role Islamic medicine played (and indeed still plays) in the progression of medical practice across the globe cannot be overstated.

## Keywords

History of Medicine, Islamic Civilisation, Balkhi, Razi, Avicenna

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## 1. Introduction

Studying history is vital, as it is history that allows us to understand how people and societies have developed. It is history that gives us the opportunity to learn about our predecessors and their achievements, as well as their struggles. Most importantly, it is through acknowledging the past that we can hope to learn from our mistakes and prevent their recurrence, and hence build future success. Understanding the history of the practice of medicine is of paramount importance; it is the practice of preserving and optimising the most valuable thing human possess-health.

This script details the origins of medicine in Muslim territories. How medicine evolved in these countries and the approach Islamic medicine took to health and illness will be discussed. The paper will focus on the history of medicine in the Arabian Peninsula, the Middle East, Egypt, Syria, Afghanistan, Iran, and Central Asia. It is divided into two sections: the first focuses on the pre-Islamic history of medicine, whilst the second concentrates on medicine after the rise of Islam, Islamic medicine, and its influence on the evolution of global medicine. The paper will also outline the main centres of medical education as well as some of the most influential physicians of these periods.

## 2. Medicine in the Pre-Islamic Period

The evolution of medicine on earth started about 6000 years ago in Mesopotamia (a region that included Iraq, Kuwait, part of Turkey, and Syria), 4000 years before Greek medicine emerged [1]. It was in the region of Mesopotamia where the world's earliest civilisation developed [2]. The Babylonians who inhabited Mesopotamia between 1894-1594 Before Christ (B.C.) were advanced in medicine, which possibly for the first time in history became an established profession. The Code of Hammurabi composed circa 1755-1750 B.C. (regarded as the "origin of medicine" [3]) enshrined a code of ethics that challenged physicians to attain higher standards of practice. Both the Babylonians and the Assyrians, who conquered the Babylonians between 1270 and 538 B.C., believed gods inflicted illness upon humans as a punishment for sins, whilst other gods cured disease as

a reward for good behaviour. Assyrian belief maintained that three demons were responsible for disease—the demons of phthisis (or decay), liver diseases, and abortion or infant death. Treatment was largely channelled through prayer and incantation. However, emetic drugs were also utilised, nauseating patients at their sight or smell. It was believed that this would disgust the culprit's evil spirit, causing it to flee the diseased part of the body [1].

In ancient Egypt, evidence suggests that the possession of medical knowledge carried incredible status. Medicine was practised by priest-physicians with remarkable knowledge in a wide range of medical fields including anatomy and rheumatology [4] as well as surgery, neurosurgery [5], and pharmacology [6].

The origins of medicine in ancient Iran (including Afghanistan, today's Iran, and parts of Central Asia) can date back to ancient times. The first written source is Avesta, the Zoroastrian religious book, the contents of which were revealed by God to Zoroaster, a native of Balkh, Afghanistan [7] around the 6<sup>th</sup> century BC, who in turn relayed the contents of Avesta to Gushtāsp, king of Bactria (Balkh), the patron of the Faith [1]. Avesta covers many aspects of health including anatomy, disease prevention, and pharmacology. Avesta describes three types of human vessels: those through which red blood passes (arteries), the vessels containing black blood (veins), and those without blood (nerves). According to Avesta, diseases can be caused by a host of factors including a demon named Ahriman, sin, poor diet, uncontrolled sexual appetite, nervous tension, or by the god Ahura Mazdā. Zoroastrian medicine recognised three methods of analgesia: namely the use of either herbs (pharmacology), the knife (surgery), or word (psychotherapy) [8]. Hence there existed three kinds of practitioners: healers by holiness, healers by knife, and healers by instruction, the latter of whom performed health-related instruction. Physicians who specialised in “preventative” medicine were called *Durustpat* or “Masters of Health” and aimed to remove the causes giving rise to disease, whilst those treating diseases and physicians practising “clinical” medicine were referred to as “*Tan Beshazak*” or “Healers of the Body”; the latter group treated disease once it had manifested. Physicians hailed from noble families who studied theology and medicine. The Zoroaster Code of medical practice expected physicians to be experienced in their profession, to be god-fearing, to communicate well with patients, to listen to their concerns, to be sweet-tongued, gentle, friendly, zealous of the honour of their profession, and averse to greed [1].

The first medical school in pre-Islamic ancient Iran was the Jundi Shapur (“Beautiful Garden”) medical school, located in modern-day Khuzestan, north-west Iran, founded by the Sassanid Emperor Shapur I (239-270 Anno Domini (A.D.) [1] [9]. It was originally established as a prison. Nevertheless, over time, it became a refuge for intellectuals from different regions and included Greeks, Syrians, and Nestorians [10] [11]. The School of Edessa (in modern Urfa in south-eastern Turkey), also known as the School of the Persians in Edessa [12], was destroyed by the Byzantines in 457 A.D. and was subsequently closed by Emperor Zeno in 489 A.D. [10] [13]). This and the further closure of

the Athenian Academy by the Byzantine Emperor Justinian in 529 A.D. led to the emigration of learned Nestorians and Greek physicians to Jundi Shapur, where they sought refuge under the patronage of Shapur II [10] [11]. Subsequently, in approximately 555 A.D. a medical centre and hospital were established by king Khosraw Anushirawan the Just [14]. It was here that a uniquely tolerant and peaceful meeting point for the study of the philosophical and medical traditions of Persians, Greeks, Indians, Zoroastrians, Jews, and Nestorians developed, serving as the foundation for the incredible medical advancements under Muslim rule. In fact, Hārith bin Kaldah al-Thaqafi, the Prophet Mohammed's (PBUH) physician, trained at Jundi-Shapur [1] [15]. The Jundi Shapur medical school remained one of the greatest centres of medical teaching throughout the Islamic world until the growth of caliph Al-Mansur's capital Baghdad in 762 A.D. [1] [16].

As far as medicine in the Arab peninsula is concerned, there is very little information available. However, it appears that Arabs were familiar with treating septic wounds and ulcers with disinfectants and understood that contagious diseases were prevented by the isolation of infected patients [1].

### 3. Medicine in the Post-Islamic Age

Following the introduction of Islam in the 7<sup>th</sup> century, an intellectual and cultural transformation in the Arab peninsula began. Islam, from its foundation, stressed that the pursuit of knowledge was a divine command, professing that knowledge brings mankind closer to God, representing the “ultimate happiness” [17]. The foundation of Islamic science was laid during the Abbasid Caliphate and the foundation of Baghdad as its capital by Caliph al-Mansur in 145 A.H./762 A.D. It is reported that Caliph al-Mansūr suffered from an abdominal disease and asked for a skilled physician in his realm to find a remedy for his illness. He was told there was no other physician more accomplished than the Nestorian physician Jirjis bin Bukhtyishu. Subsequently, Jirjis, then Chief of the Jundi-Shapur Hospital, was summoned to Baghdad. Jirjis treated the Caliph Mansur and was appointed the court physician [1] [18]. During the succeeding years, many scientific texts were translated into Arabic from works from the Syriac, Greek, Sanskrit, and Pahlawi languages [1] [19]. Scientists such as the Jewish Masha' Allah al-Yahudi, Al-Muqaffa', a Zoroastrian who converted to Islam, and physicians including the Bukhtyishu family and the Nestorian Hunayn ibn Ishāq, were summoned to Baghdad [20]. During the next six centuries, medicine alongside other fields of science reached its peak, and prominent physicians and scientists emerged in the Islamic lands to give immense contributions to global civilization.

### 4. Hospitals

The first Bimāristān (hospital) in the post-Islamic era was built in Damascus in 88 A.H./707 A.D. [15]. The first Bimāristān in Baghdad was built during the

reign of Caliph Harun Al-Rashid (170-193 A.H./786-809 A.D.) with Jibrail Bukhtyishu as its head physician. Subsequently, three more hospitals were built in Baghdad, including the Bimâristân al-Sa'di (279A.H./892 A.D.), Bimâristân al Sayyidah (306 A.H./918 A.D.), and the Mansûrî hospital (981 A.D.) with Al-Razi as its principal physician [21]. The first hospital in Afghanistan (Ghazni) was built during the reign of Sultan Mahmoud of Ghazni (998-1030 A.D.), which also had *Darul-Majânin* ("madhouse") or a mental health section [22]. The first hospital in Iran (Isfahan), with Abu Ali Sina as its chief physician, was built during the reign of Ala'ud Dawla (1008-1041 A.D.) [8]. The first hospital in Marrakesh was built in 1199 A.D. The first hospital in pre-Ottoman Turkey was constructed in 1205 A.D. in Kayseri; two more were erected in Sivas in 1217 A.D. and Amasya in 1308 A.D. [23]. The Al-Mansuri Hospital in Cairo was built in 1284 A.D. with a capacity of 8000 beds [24], whilst the first hospital in Grenada was built in 1397 A.D. [25].

## 5. Influential Physicians

The **Bukht Yishu** family of the Syrian, Nestorian background produced ten extraordinary physicians who served between the 8<sup>th</sup> and 11<sup>th</sup> centuries. There is very little information available about the founder of the family, Bukht-Yishu I, who was born in Baghdad [26]. His name was Syriac, meaning "Jesus hath delivered" [20] or "Jesus saved" [19]. His son Jirjis I (died 152 A.H./769 A.D.) served as the court physician of Caliph al-Mansûr (754-75 A.D.); and his grandson, Bukht Yishu II (died 185 A.H./801 A.D.), the court physician of Caliph al-Mahdî (775-85 A.D.) and Hârun al-Rashîd (786-809 A.D.) [27]. Jibra'il ibn Bukht-Yishu II (died 213AH/828/9 A.D.), son of Bukht Yishu II, served as the court physician of Hârun al-Rashîd, al-Amin (809-813 A.D.) and al-Ma'mun (813-833 A.D.). Other members of this eminent physician family included Bukht-Yishu III ibn Jibra'il (died 256 A.H./870 A.D.) the court physician of Abbasid Caliph, al-Mu'taz (866-69 A.D.); Yahyâ or Yuhanna, Bukht-Yishu IV (died 329 A.H./941 A.D.), the court physician of Caliph al-Muqtadir (929-932 A.D.); Ubaydullâh ibn Jirjis II, the court physician of al-Muttaqî (940-944 A.D.); and finally, Jibrail ibn Ubaydullâh and his son Abu Sa'id Ubaydullâh [20].

**Hunayn ibn Ishâq al-Ibādî** (died in 260 A.H./873 A.D.) known as Joannitus was a Christian scholar, born in Baghdad, and the pupil of Yahyâ (or Yuhanna) Mâsawayh of Jundi Shapur. Hunayn translated many Syriac and Greek works into Arabic [18] [27] [28] [29] including *Fusûl* or *Aphorisms* of Hippocrates [20].

**Ishâq bin Imrân** (died c. 903-9 A.D.) was an Arab physician born in Tunisia who composed the *Al-maqâla fil-malikholyâ* (the treatise on melancholy) [30] which was the first written treatise on melancholy in Arabic strongly influenced by the Rufus's "On Melancholy" [31].

**Ahmad bin Sahl Abu Zayd Balkhî** (849-934 A.D.) born in Balkh, Afghanistan [18] [19] [32] was the founder of the Balkhî School of Geographers in Bagh-

dad [33], and the author of seventy books [27] [34] including the book of *Masālih al-Abdān wa al-Anfus* (“Sustenance for Body and Soul”). Balkhi was one of the first physicians to define panic attacks (*al-fāza*), phobia (*al-khawf*), and obsessive-compulsive disorders (*al-waswasah*). Balkhī, 1100 years ago, brilliantly differentiated between *al-huzn* (normal sadness), and *al-jaza* (depression); the former being reactive—“the causes clearly known, such as loss of a loved relative, or loss of something”—and the latter being endogenous depression, that “has no reasons; it is a sudden affliction of sorrow, which persists all the time preventing the afflicted person from physical activity, or feeling any happiness or enjoying any pleasure” [35] [36] [37]. It wasn’t until 1899 A.D. when Emil Kraepelin introduced “psychogenic depression” and Kurt Schneider in 1920 A.D. “reactive” depression. The term “endogenous” came into existence around 1893, proposed by Paul Julius Möbius. Endogenous depression was described by Emil Kraepelin as a form of depression that tends to come out of the blue [38]. When comparing the two, it is remarkable how similarly Balkhi and Kraepelin describe endogenous depression.

**Abu Bakr Muhammad ibn Zakariyā al-Rāzī** (c. 865-925 A.D.) born in Ray, Iran, known also as Rhazes, was one of the greatest practitioners of the Islamic medicine to ever live. He was a prolific writer who composed more than one hundred works on metaphysics and medicine. *Firdausu’l Hikmat* (Paradise of Wisdom), *Al Faraj ba’dā’sh-Shadda* “Joy after Sorrow”, and *Al Hāwī* are amongst Razi’s most famous works [27]. Alongside writing, Rāzī devoted his attention to Alchemy, on which he wrote twelve books [20]. Rāzī was the first who recommended clinical trials, stating “if you want to study the effect of bloodletting on a condition, divide the patients into two groups, perform bloodletting only on one group, watch both and compare the outcome”. Furthermore, he wrote *Kitab fi al-Jadari wa al-Hasbah*, an influential book on measles and smallpox, and the first book on paediatrics [39]; hence, Rāzī is regarded as “the father of paediatrics” [40]. In terms of neuropsychiatry, Rāzī in the first part of the *Al-Hāwī* (in the section entitled “brain diseases”) classifies neuropsychiatric disorders into the following categories: 1) “*malīkholyā*” or melancholia [41]; 2) “*sar’a*” (seizure), and *um-al sabyān* literally meaning the “mother of a demon that hurts children” [19], infantile epilepsy; 3) “*kābus*” (nightmare) and *al-tafaza’ al-nawm* (nocturnal panic disorder); 4) *al-tashannuj, wa al-tamaddud wa al-kazāz* (spasms and movement disorders); 5) *qeranits b’infirād wa ishterāk al-junun* (simple and psychotic phrenitis); 6) “*qhutrub*”, described as an agitated form of psychosis, similar to hebephrenic or catatonic-like psychosis; 7) *māniā*; 8) “*hazyān*” or delirium; 9) *jam’ al zurub-alsahar* (all kinds of insomnia); and finally; (10) *Al-sudā’a wa al-shaqīqa wa al-mā’ fil rā’s* (headaches, migraine, and hydrocephalus) [41] [42].

**Hakim Maysarī** authored the *Dāneshnāma* (Medical Encyclopaedia), the only medical manuscript written poetically in Farsi-Dari (Persian) [43] [44]. There is little information about Maysarī’s life, however, it transpires from the *Dāneshnāma*



that he was from eastern Persia (today's Afghanistan) and completed *Dāneshnāma* in 370 A.H./978-9 A.D. There was only one similar medical manuscript written by Yūsuf bin Muhammad, a doctor, and poet from Herat (Afghanistan) who lived during the reign of Bābur (932-37 A.H./1526-30 A.D.), the founder of the Mogul Empire in India and Homāyūn (937-63 A.H./ 1531-56 A.D.). His works span all branches of medicine [45]. Maysarī dedicates his book to emir *Nāsir al-Dīn wa'd Daula*, Sebüktegin who established the Ghaznavid Empire in 977 A.D. in Ghazni, Afghanistan [22] [46]. *Dāneshnāma* hence is the first known medical book written in Afghanistan. *Dāneshnāma* is a relatively short medical encyclopaedia comprising 4505 verses; it is an invaluable medical resource that covers a wide range of subjects including neuropsychiatry, ophthalmology, cardiology, respiratory medicine, dermatology, gynaecology, sexology, and more. The book is structured as follows: 1) on "*mizā*" (temperament), 2) on acute pains, 3) on remedies, 4) on clinical medicine, covering a wide spectrum of health problems "from head to toe" starting with hair loss and ending with feet corns and callus; 5) toxicology, and 6) fever. As far as neuropsychiatric conditions are concerned, Hakim Maysarī was one of the first physicians to describe the symptomatology and treatment of neuropsychiatric conditions such as melancholy, *rejā* (pseudocyesis), *ikhtenāq e rahm* (hysteria), and pseudo-seizure, *shaqīqha* (neuralgia of trigemini nerve or/and migraine), *dawwār* (vertigo), *sarsām* (meningitis, encephalitis), *sobāt* (hypersomnia), *shukhūs* (syncope), *sar'a* (seizure), and *kābus* (incubus). *Dāneshnāma* is probably the first medical book in post-Islamic medicine that openly discusses issues that are still rather proscribed even today, such as sexual dysfunction, loss of libido, ejaculation praecox, vaginism, dyspareunia, nymphomania, satyriasis, elongation, and enlargement of the penis, contraction of the vagina, and issues around contraception [44].

**Abu Mansūr Mowaffaq bin Ali Herawī** (died ca. 978-88 A.D.) was a physician and pharmacologist from Herat, Afghanistan, and the author of *Al-abniya an haqā'eq al-adwiya* ("Basics Facts about Medicines") written in 447 A.H./1055 A.D. This is the oldest book of pharmacology written in Farsi-Dari [45]. In this book, Herawī reviews 584 remedies, including their mode of actions, indications, efficacy, side effects, adverse effects, and geographical origins. He provides Arabic, Greek, Indian, Farsi-Dari, and Syriac names of the drugs [47] [48]. When discussing indications of the remedies, Herawī refers to other physicians including Razi and Galen but most often to Pedanius Dioscorides (ca.40-90 A.D.), the Greek physician, pharmacologist, and botanist, and the author of the monumental *De Materia Medica* [49] [50].

**Abu'l Khayr Hasan bin Sawār, Khammār** (942-1046) was a Christian physician born in Baghdad [18] [28] [29]. He was described by Nizami-Aruzi as the third after Hippocrates and Galen in the science of medicine [20] [26]. Khammār was the chief physician of the Royal Hospital in Ghazni [22], and the court physician of Sultan Mahmūd (388-421 A.H./998-1030 A.D.), Sultan

Mas'ūd I (421-32 A.H./1030-41 A.D.), and Bahrāmshāh [18].

**Ali ibn Abbās al Majūsī** (949-994 A.D.) known as “Haly Abbas” [51], born in Ahvaz, Iran, was a pioneering physician and surgeon who influenced the Western world with his monumental work, *Kāmil ul-Sinā'a ul-Tibya* (“The Comprehensive Book of Medical Art”). This was also known as *Kitābu'l Malikī* or “The Royal Book” [52]. Majūsī in the introduction of this book declares “what I saw in the old medical books from the time of Hippocrates until now was incomplete. A complete and comprehensive book on science and all fields of medicine has not been written until this era”. His book was a medical one covering all medical subjects. The Malikī book was the main medical book used by physicians before the Avicenna's Qānūn; however, when comparing Qānūn and the Royal Book, the Qānūn was deemed stronger on the theoretical, though weaker on the practical, side [19] [20]. In psychiatry, Majūsī categorised mental disorders into: 1) *malikholyā* (melancholy), 2) *haymān* (love madness), 3) *qhutrub* (defined as a form of agitated melancholy), 4) *sarsām* (inflammation of the head, or meningitis), 5) *barsām* (inflammation of the chest or the “curtain located between heart and lungs”), characterised as a syndrome of delirium, 6) *sobāt* (hypersomnia, or narcolepsy), 7) *sobāt-ul-saharī* (narcolepsy or agrypnocoma), and 8) *zawāl hāfeza* (dementia). As far as the aetiology of mental disorders is concerned Majūsī's perspective is holistic and refers to the three main aetiological factors like a) “physical” factors (temperament, humour, physical predisposition, personality, etc.), b) “non-physical” factors, like excessive emotions as sadness, fear, and anxiety, and c) “environmental” factors. Furthermore, Majūsī believed “qhutrub” was hereditary, but that nonetheless melancholy was caused either by brain dysfunction, damage to the stomach, or impairment of other organs [53].

**Abu Bakr Rabī ibn Ahmad al-Akhwayani al-Bokhārī** (died 983 A.D., Bukhara, Uzbekistan) lived in northern Afghanistan and Bukhara, and was the author of *Hidāyat al-Muta'allemin fi al-Tibb* (“A Guide for Medical Students”), the third oldest medical book written in Farsi-Dari [54]. Bokhārī wrote on different subjects of medicine, including contraception [55] sarsām or meningitis [56], and made the distinction between seizure and pseudo-seizure [57]. For his knowledge of mental disorders, Bokhārī became known as *Pezeshk-e-Divanegan* [58]. Bokhārī classified mental disorders into: 1) *malikholyā* or melancholia, [54] 2) mania, 3) *qhutrub*, 4) “*kābus*”—a nocturnal panic disorder, 5) “*Rejā*” (pseudocyesis) and 6) “*Khonāqḥ-ul-rahm*” (hysteria) [54] [59].

**Abu Mansūr Hasan, ibn Nūh al-Kamarī** (died c. 999 A.D. in Bukhara), the court physician of Sāmānids (892-999 A.D.) and Avicenna's teacher, was a versatile physician and author of many books, including the *Al-Tanwīr fi al-Iṣṭilāḥāt al-Tibbiyya* or Enlightenment into medical terminology [60] and *Al-Ghina wa al-Muna* or the “Book of Wealth and Wishes” [8] [58] [61].

**Abu Ali Hussein, ibn Abdullah ibn Sīnā**, Latinised, **Avicenna** (980-1037 A.D.) born in Balkh, Afghanistan [1] [39] was described as “the Philosopher of the East, the Proof of God unto His creature” [20] [26]. Avicenna authored 450



books, including the monumental *Qānūn fī Tib* (“Canon of Medicine”) and *Shefā* (“The Book of Healing”). *Qānūn* is amongst the most influential medical books and was a standard medical text, remaining in use until the 17th century [8]. *Qānūn* was so revered by physicians that Nizami-Aruzi stated that “if Hippocrates and Galen were resurrected, it would be permissible for them to prostrate before this book” [20] [26]. In anatomy, Avicenna was the first physician to prove that only humans have clavicles and was the first to locate the stomach in the left part of the abdominal cavity. Unlike Galen, who assumed the heart was on the middle of the chest, he specified that the heart was in the left side. He concluded that the spinal cord was a continuation of the brain and contained sensory, motor, and mixed fibres. He accurately distinguished between skeletal and smooth muscle functions. Avicenna accurately described the bicuspid and tricuspid heart valves, as well as the aortic valves and their functions. In describing the anatomy of the testicles, he demonstrated that there was a “fertile” and “infertile” fluid. Moreover, Ibn Sina was the first to describe the configuration of the eye muscles. In infectiology, Avicenna concluded that measles, smallpox, and plague have an infectious origin. He pointed out the existence of “small disease-causing creatures.” Avicenna was the first to postulate the parasitic origin of filariasis. In surgery, he routinely performed surgeries such as removing bullets, stones, and tumours, stressing the need to excise tumours as soon as possible. Avicenna can be considered the discoverer of tracheotomy. He is one of the founders of paediatrics, noting that the child’s body differs from the adult not only in size but also in its peculiarities. In neurology, Avicenna was the first physician to provide the clinical manifestation of sarsām-e sard or lethargic “Economo’s encephalitis” [8], more than 1000 years ago before Constantin von Economo [62] [63]. In mental health, Avicenna considered exhaustion, abuse of drugs, as well as infectious diseases, congenital factors, constitutional anomalies, moral failures, and sexual deviations, to be causes of mental disorders. Avicenna is likely the first physician who used an animal model to demonstrate the negative effects of stress on health. He is known for his experiment where he kept two lambs in the same environment, except that one of them faced a wolf whilst the other could not see the wolf. Both lambs were looked after equally, but the lamb that directly faced the wolf died after a while, whilst the other survived. He was the first to connect various mental activities and disorders with certain parts of the brain. He confirmed that mental illnesses are no different in origin from somatic ones and rejected the belief that evil spirits were the cause of mental illness. He was well experienced in psychosomatics, claiming that there was an “invisible” connection between the soul and the body; something like a bridge over a river, where if there is a change on one bank, the other will be affected similarly. In the treatment of mental disorders, in addition to medication, Avicenna recommended ergo therapy, music therapy, and physical exercise [8]. Avicenna classified mental disorders under the followings categories: 1) sleeping disorder, including both hypersomnia (*sobāt*) and insomnia, 2) acute and transient

brain dysfunctions, including transient memory disorders, disorganised behaviours, and perceptual disorders; 3) *hazyân* (delirium), 4) *ru'unat wa hamâqhat* (mental retardation), 5) *Fasâd-e-zehn* (dementia), 6) *fasâd-e-takhayyol* (corruption of imagination), 7) *mâniâ*, and *dâ-al-kalb* ("dog's disease", a mixed psychosis fluctuating between calmness and hostility), 8) *malikholyâ* (melancholy), 9) *qhutrub*, 10) *eshqh* (love) disorder; and 11) *ikhtenâq-ul-rahm* (uterine suppression or hysteria). As far as melancholy is concerned, Avicenna recognised five forms of melancholia: a) sanguinolent melancholy described as a form of illness, which presented with "laughing and happy imaginations", b) melancholic melancholy, associated with "lachrymosity and suicidal ideations", c) "cerebellar" melancholy, characterised by symptoms of "deep thinking, prolonged and excessive obsessive thoughts, poor eye contact, etc." d) "splenic" melancholy, associated with "anorexia and fever", and e) "ventricular" melancholy. In terms of mania, Avicenna recognised two types of mania; *sobârî* or agitated, psychotic mania, and *hârî* or inhibited mania without psychomotor agitation. With regards to the treatment of mental disorders, Avicenna provided several treatment alternatives, including medications and bloodletting. However, he suggested that if patients are extremely agitated or at risk of suicide, they should be "securely placed in a cage and hung from the ceiling". He also recommended that if patients were agitated or aggressive and medications ineffective, "one could hit the patient on the head or slap them or burn their head" [64].

**Abu al-Qâsim Khalâf ibn al-Abbâs al-Zahrâwî**, Latinised **Abulcasis** (936-1013 A.D.), was born in Zahra, northwest of Cordoba and because of exceptional skill in pharmacology and surgery, he was also known as the "Pharmacist Surgeon". Al-Zahrâwî is the author of *Kitâb al-Tasrîf*, a thirty-volume encyclopaedia of medical practice [65]. He invented numerous surgical instruments, including the use of catgut, the ligature, the surgical needle, the retractor, and the surgical rod [66].

Of **Abu Rayhân Muhammad ibn Ahmad al-Bîrûnî** (362 A.H./973 A.D.-440 A.H./1048 A.D.), there is little information regarding his origin; Bîrûnî lived most of his life in Afghanistan and India under the rule of Ghaznavid sultans of Afghanistan [18] [46]. Al-Bîrûnî was a polymath universal scientist, who is described as one of the "greatest men science has produced", and as "a phenomenon in the history of Islamic learning and literature" [20]. Al-Bîrûnî wrote hundreds of works, including his masterpiece *Al Âtharu'l Bâqiya an'l Qurûn'l Khâliya* (Chronology of Ancient Nations) in the field of history [67], and *Kitâb-al Sidana fi al-Tib* (The Book of Pharmacy in Medicine), which details more than 1000 drugs of various origins [8].

**Sayed Zayn al-din Ismâil bin al-Hasan, bin Mohammad, bin Mahmud, al-Husaynî, Jorjânî** (434 A.H./1042 A.D.-531 A.H./1137 A.D.) was a versatile physician and the author of *Zakhîraye Khwârazmshâhî* (The Treasure of Khwârazmshâh) [18] [20] [29] [68] [69] which was composed at the court of Khwârazmshâh Qutbuddin Muhammad (491-522 A.H./1098-1128 A.D.) and

*Al-Aghrād'ul tibiyah wa'al-mabāhith'ul Alā'iyah* (The Aims of Medicine), dedicated to Sultan Alā' ad-Din Qizilarsalān Atsiz who ruled Khwarazm (a vast region consisting of most of Afghanistan, east of Iran and parts of Central Asia) between 1127 and 1256 A.D. [19] [20], both written in Farsi-Dari [45] [70]. In surgery, Jorjānī introduced different methods and instruments of surgery. He explained methods of stopping severe haemorrhages by casting them with plaster, treating the obstruction of air canals by tracheotomy, curing the difficulty in urination by catheterization, the exact method of removing apophysis, and stitching the spot after cutting and paring in polyp surgery in full detail. Moreover, he highlighted the association between exophthalmos and goitre, and the correlation between the expansion of thyroid glands and an increase in heart rate. In this way, medicine came to understand the pathologic toxic reactions of thyrotoxicosis [71]. In neuropsychiatry, Jorjani in his *Al-Aghrād'ul tibiyah* dedicates a full chapter on “illnesses of the head” where neuropsychiatric illnesses are listed. In terms of the psychopathology of mental disorders, Jorjani talks about the two-dimensional or two-syndrome model of mental disorders, dividing them into two categories; firstly, those that “warm and move the limbs, the humours, and the spirit, such as anger, joy, hope, and thoughts”; and secondly, those that “cool and slow down the limbs, the humours, and the spirits, such as sadness, fear, and similar things” [70]. Jorjani understood mental disorders as “the diseases of the brain substance”, classifying them into 1) *malikholyā* or melancholy, “the person suffering from this illness is always negative-thinking, fearful, and sad”, 2) *dīwānagī* (madness), 3) *ghaflat* and *nasyān* (memory problems and dementia), defined as “inability of imagining and accordingly describing things and lack or decline of intellect”, 4) *ahmaqhi* (mental retardation), 5) sleeping problems such as a) *sobāt* outlined as “excessive sleeping” (hypersomnia), b) “excessive lack of sleep” (insomnia), and c) *kābus*, described as a syndrome “when people in the sleep think something heavy is on their chest, pushing them to the extent they would not breathe, unable to scream or to move, and this could be a prodrome of seizure, stroke, or madness, called mania”, and 6) *sar'a* (seizures). Jorjani categorises “madness” into four types, namely 1) mania, described as form of “madness” and “the person affected by this illness is mad that gets the temperament of thieves, and his gaze will look like a gaze of thieves”; 2) *dā' al kalb* (dog's disease) when the affected persons will “have the temper of dogs, sometimes behave unfriendly, on other occasions behave kindly”; 3) *sobārā*, described as “a severe form of madness associated with mania” accompanied by fever; and 4) *qhutrub*, described as an agitated form of psychosis, because “individuals affected by this madness are like qhutrub, the small mosquito-like fly (dragonfly) that moves fast and erratically over the water, will not rest” [70].

**Abu-Marwan Abdel-Malik Ibn Zuhr**, Latinised Avenzoar (1094-1162 A.D.), born in Damascus, Syria, the author of *Al-Taysir fi al-Mudawāt wa al-Tadbir* (“On Preventive Regimen and Treatment”), is one of the first physicians to describe hydrocephalus [72] and gave the first detailed report of cancer of the co-

lon [73]. He used animal testing, and post-mortem autopsies [74].

**Ala-al-Din Abu al-Hasan Ali ibn Abi-Hazm al-Qarshi al-Dimashqi** known as **Ibn al-Nafis** (1210-1288 A.D.), born in Damascus, laid the foundation of physiology and was the first physician to describe the pulmonary and the coronary circulation [75] [76] [77].

**Mansūr ibn Muhammad ibn Ahmad ibn Yūsuf ibn Ilyās** (1380-1422 A.D.), born in Shiraz, Iran, was a physician and the author of the first colour illustrated atlas of anatomy or *Tashrīh-e Mansūrī* or The Mansur's Anatomy [78] [79].

## 6. Discussion

History is, in short, an art of investigation of the past, and principally, the collection of data, their organisation, and interpretation. As far as the history of medicine in Islamic territories is concerned, this task is extremely difficult. Firstly, when it comes to the collection of data it is very arduous to collect data as most of the sources have been destroyed or damaged, and those available are not easily accessible. Secondly, the interpretation of data poses a significant challenge, as during the past millennia the geography of the Islamic civilisation has significantly changed, including the names of countries. Finally, when discussing the history of Islamic medicine, one must specify whether the subject of the investigation is specifically the history of Arab medicine or the history of medicine in Islamic civilisation in general. Some interchangeably use the term “Arabic” and Islamic’ as equivalent, which leads to some misinterpretation, as not all Muslims are Arabs and vice versa. Hence, we prefer the expression “Islamic” instead of “Arabic” as a more fitting term.

Evidence indicates the evolution of medicine in Islamic civilisation began millennia before the rise of Islam in the 7<sup>th</sup> century and is associated with the development of medicine in neighbouring regions, such as Mesopotamia, ancient Persia, Greece, Egypt, and India, where the medicine was highly advanced. The foundation of Islamic science was laid during the reign of caliph Mansur (754-75 A.D.) and the foundation of Baghdad as its capital in 762 A.D. The first three centuries of Abbasid rule (the eighth to eleventh centuries) saw the summit of medieval Islamic civilisation. Literature, theology, philosophy, and natural sciences (including medicine) all flourished, with fertilising influences from Persia and the Hellenistic world [80]. Further principal centres of Islamic civilisations were Bukhara, Balkh, Damascus, Ghazni, Herat, Nishapur, and Ray, where scientists of diverse religions, races, and nationalities worked and resided in harmony [8]. As in the pre-Islamic times, as well as in the post-Islamic ages, medicine was strongly influenced by Greek medicine. The influence of Greek medicine was even stronger in the post-Islamic evolution of medicine because of the translation of Greek medical literature into Arabic. In fact, early Muslim physicians, including the most prominent of all physician-philosophers Avicenna and Razi, recognise the influence of Greek medicine on their work and expressed admiration of Greek physicians such as Socrates, Galen, and Rufus, etc.

On the other hand, the advances and innovations in medical science and healthcare systems achieved during the early and medieval Islamic ages have unarguably contributed to the evolution of medicine throughout the world and to the establishment of various procedures and practices which are still relevant today. In spite of this, most Western medical textbooks rarely mention Muslim physicians, as their contribution is under-represented. Singh [81] has reported systematic bias against India in Western literature on the history of medicine. As highlighted by Kabeer & Tsai [82], the typical Western view of scientific history is distorted and incomplete. This phenomenon could be associated with selection bias of historical sources. In fact, recent evidence suggests there is a widespread prevalence of selection bias in historical sources [83]. Unfortunately, unfair accounts of the past are the result of historians' bias, of their preferring one account over others because it aligns with their interests [84]. A typical example of this bias is seen in Avicenna, whose ethnic origin is disputed by Turks, Persians, and Arabs. Whilst Turkish medical literature refers to him as Turkish [23], most Iranians refer to Avicenna as Iranian [85]. In actuality, Avicenna hailed from Balkh, Afghanistan [1] [18] [29], and neither modern Iran nor Turkey regarding his ethnicity, both Iranians and Turkish ethnic groups have lived (and still live) in Afghanistan.

## 7. Conclusion

The evolution of "Islamic" medicine began millennia before the rise of Islam in the 7<sup>th</sup> century. Furthermore, the history of medicine in Muslim territories is very complex and is incredibly closely related to as well as influenced by the evolution of medicine in neighbouring nations, namely Mesopotamian, Egyptian, Persian, Indian, and predominantly, Greek medicine. On the other hand, the advances and innovations in medical science and healthcare systems that were achieved during the early and medieval Islamic ages have significantly contributed to the evolution of global medicine, and to the creation of several procedures and practices which are still widely performed today. Hence, the value of comprehending the pivotal role Islamic medicine played (and indeed still plays) in the progression of medical practice across the globe cannot be overstated.

## Collaborators

RM, RM-A, AO, TA-K, NS.

## Acknowledgements

The authors acknowledge the help of colleagues Dr. Walid Sorour and Charlotte Auty for their help with the preparation of this manuscript.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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