ORIGINAL ARTICLE

Classification of Cranial Nerves from Galen to Soemmering, Focusing on the Contributions of Persian/Unani Scholars

Abstract

The evolution of neuroanatomy has been profoundly shaped by the contributions of medical intelligentsia across civilizations. The chronology of the identification and nomenclature of the human cranial nerves reflects a continuum of inquiry spanning antiquity to the modern era. This article examines the anatomical descriptions of cranial nerves through the lens of ancient, medieval, and early modern medical scholarship. Special focus is given to the contributions of Persian and Unani scholars, whose meticulous observations often parallel contemporary neuroanatomical findings. While certain differences exist—particularly in the enumeration and trajectories of cranial nerves—the foundational insights of these scholars remain remarkably prescient. This review draws upon graphic and textual sources from influential figures, such as Galen, Rhazes, Tabari, Haly Abbas, Avicenna, Ismail Gorgani, and Soemmerring. These works, especially from the medieval period, served as vital conduits in preserving and advancing anatomical knowledge. By mapping the progression of ideas and anatomical detail, this study highlights the significant yet often underrecognized role of Islamic Golden Age scholars in shaping modern neuroanatomy. The compiled evidence underscores the enduring relevance of classical texts in tracing the historical development of cranial and spinal nerve anatomy.

Key words: Cranial Nerve, History of Nerves, Unani/Persian Medicine, Neuroscience in Unani, Neuroscience in Persia, Neuroanatomy

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Introduction

The chronicle of mankind's quest to understand the brain and its intricate connections with the spinal cord and peripheral nerves spans across millennia. From the rudimentary neurological ideas of ancient civilizations to the elaborate anatomical illustrations of the Renaissance, the journey reflects both a scientific and philosophical evolution. Among the earliest intellectual traditions that significantly shaped neuroanatomical understanding was the Greco-Persian-Arabic medical system, known as Unani medicine, which meticulously documented anatomical structures and physiological functions with remarkable depth and logic.

Primitive yet insightful descriptions of neurology and psychiatry can be traced back to early civilizations such as Babylon, while the term nerve itself originates from the Greek word for tendon, reflecting the early attempts to grasp the physiological pathways of sensation and movement (Reynolds, and Kinnier Wilson, 2014, pp. 2611–2619).

In classical literature, a profound statement encapsulates the role of nerves (*A'ṣāb*): "*Nerves serve as channels through which sensory impulses spread throughout the body, resembling the branching flow of a river and its tributaries*." (Avicenna, n.d., pp. 70-73; Jurjani, 2010, pp. 87-91; Majoosi, 2010, p. 132). This metaphor reflects the enduring fascination with the nervous system's complexity. The present classification of the twelve cranial nerves evolved gradually through cumulative anatomical observations made by eminent scholars, beginning with Galen and culminating in the work of Soemmerring, with each contributor enhancing the understanding of these vital neural structures.

Tagging and identification of cranial nerves has historically been a challenging endeavour. The first recorded descriptions are attributed to Herophilus (335–280 BC) and Erasistratus (304–250 BC), physicians of the Alexandrian school, who performed anatomical dissections to investigate the structure of the brain and nervous system. (García Ballester, 1974, pp. 7–26; Walshe, 2016; Smith, 1971, pp. 77–98). However, a major breakthrough in the identification and classification of cranial nerves came in the 2nd century CE, through the work of Claudius Galen (Jalinoos, 131–201 CE), a foundational figure in Unani medicine whose influence persisted through the Islamic Golden Age (Simon, Marečková-Štolcová, and Páč, 2011, pp. 447-452; Flamm, 1967, pp. 285–297; Lyson, et al., 2010; Antic, and DeMay, 2014, pp. 103–107).

Persian and Unani scholars not only preserved Galenic medical knowledge but also expanded it through careful study, interpretation, and clinical observation. Eminent physicians including Zakariya al-Razi (Rhazes, 865–925 CE), Ali Ibn Abbas al-Majusi (Haly Abbas, 949–982 CE), Abu Sahl al-Masihi (960–1010 CE), and Avicenna (Ibn Sina, 980–1037 CE) contributed significantly to the field of neuroanatomy, especially in explaining the anatomy and physiological roles of the brain (*dimāgh*) and cranial nerves (*A'ṣāb-e-Dimāghi*). (Modanlou, 2008, pp. 673–677; Ghaffari, et al., 2014, pp. 299–301; Heydari, et al., 2014, pp. 1161–1162; Ghaffari, et al., 2015, pp. 173–177; Hosseini, et al., 2011, pp. 647–650; Rosenthal, 2024). Razi, for instance, made notable advancements in describing the localization and function of the brain and its connections to the sensory (*hissī*) and motor (*harkī*) systems (Razi, 1991, p. 152; Amr, and Tbakhi, 2007, pp. 305–307).

Time and again, ancient and medieval anatomists provided extensive texts and numerous manuscripts on neuroanatomy. Persian and Unani scholars brought order to this wealth of information by organizing it innovatively and logically. Their efforts resulted

in significant additions to the legacy of neurological science. These insights are found in classical works such as *Al-Qanoon fi't-Tibb*, *Kitab al-Mansoori*, *Zakheera Khwarazm Shahi*, and *Kitab al-Mia*, which not only preserved but also expanded upon earlier Greco-Roman texts.

This article, in alignment with the stated methodology, revisits these foundational texts alongside modern neuroanatomical references, including Gray's Anatomy, Tortora, BD Chaurasia, and Netter's Atlas of Human Anatomy. The study seeks to explore the historical development of each cranial nerve from its anatomical origin to its distribution, analyze the progression of their terminology over time, and emphasize the classical descriptions and illustrations that contributed to the early understanding of these neural structures. In doing so, we underscore the significant but often overlooked contributions of Persian and Unani physicians to the development of cranial nerve anatomy—contributions that predate and, in some cases, anticipate findings of post-Vesalian European anatomists.

By integrating traditional Unani perspectives with contemporary anatomical frameworks, this study seeks to bridge the historical and modern narratives of cranial nerve anatomy. It reflects on how classical knowledge, far from being obsolete, can inform and enrich modern scientific discourse when re-evaluated with logical and empirical scrutiny.

Methodology

This review critically examines the descriptions of the brain and cranial nerves found in Persian and classical Unani medical literature alongside contemporary anatomical texts. The study primarily relies on translated versions of original Arabic manuscripts, including *Al-Qanoon fi'l-Tibb*, *Zakhira Khwarazm Shahi*, *Kitab-ul-Miah*, and *Kitab al-Mansoori*. Modern anatomical concepts were compared using standard references such as Gray's Anatomy, Atlas of Human Anatomy, Tortora's Principles of Anatomy and Physiology, and BD Chaurasia's Human Anatomy. Additional supportive data were obtained from published neuroanatomical studies indexed in databases including PubMed, Medline, Elsevier, and Google Scholar.

The present article surveys the available literature to provide a historical account of the development of cranial nerve anatomy from antiquity to the modern period. Particular attention has been given to the changing nomenclature of cranial nerves, notable eponymous descriptions, and classical anatomical illustrations that influenced early neuroanatomical concepts. Through this historical appraisal, the study highlights the cumulative contributions of successive scholars and also discusses the inherent limitations of earlier cranial nerve classification systems.

Literature Review

Over subsequent centuries, the classification, terminology, and representation of the cranial nerves underwent considerable modification. These developments were closely associated with advances in anatomical illustration, printing techniques, and the publication of medical texts, which collectively shaped the presentation of neuroanatomical knowledge. A notable feature of the major anatomical atlases produced during different periods was the collaborative contribution of skilled scholars, anatomists, and illustrators whose combined efforts enriched the understanding of cranial nerve anatomy.

As early as the fourth century BCE, the Greek philosopher Aristotle (*Arastu*) proposed that nerves originated from the heart and were governed by it. He considered the heart to be the primary organ of the body and the central source of sensation as well as movement. (Tabari, 1995, pp. 95-97; Tabari, 2010; Rocca, 2003; Nuland, 1995, pp. 2, 13; Pinchot, and Gersten, 1930).

Hippocrates formerly gave insights about the brain: "*The brain is the most influential/ dominant organ* (*Uḍw-i- Ra'is*) *of the body; the seat of mental processes* (*nafs-e-natiqa*), *and the site of psychic functions like* (*Af'āl Nafsāniyya*) *intellect and function of modification*."(Avicenna, n.d., pp. 494-496; Majoosi, 2010, pp. 126-130, 448; Arzani, 2002, pp. 136-144; Qarshi, 2010, p. 64)

1- Galen's View

Approximately six centuries later, the Roman physician Galen (Figure 1) challenged Aristotle's concept and endorsed the earlier views of Hippocrates by asserting that the brain, rather than the heart, was the principal organ responsible for sensation and movement, with nerves originating from it. In On the Teachings of Hippocrates and Plato, Galen explained that the brain serves as the source of nerves responsible for sensation and voluntary motion, whereas the heart gives rise to the arteries and innate heat, and the spinal cord functions as a continuation of the brain transmitting sensory impulses to the limbs (Pinchot, and Gersten, 1930; Baloyannis, 2003, pp. 97-117; Hansotia, 2003, pp. 327-332) Galen then provided a detailed account of nerves. He systematically organized anatomical knowledge and authored detailed anatomical treatises that contained important descriptions of the cranial nerves. His understanding of human anatomy was largely derived from dissections performed on animals (García Ballester, 1974, p. 7-26). Despite acknowledging that the dissection of nerves was laborious and technically challenging, Galen provided sufficiently detailed descriptions of the cerebral nerves, enabling modern scholars to correlate them with present-day cranial nerves. He recognized seven pairs of cranial nerves and classified them sequentially from I to VII: the optic nerve as the first pair, the oculomotor as the second, the trigeminal components as the third and fourth, the facial and auditory nerves as the fifth, the glossopharyngeal–vagus–accessory complex as the sixth, and the hypoglossal nerve as the seventh pair (Smith, 1971, pp. 77-98.). (Table 1) Galen's classification of seven pairs of cerebral nerves continued to dominate

Figure 1. Galen (*Galen, n.d.*)

anatomical thought and remained largely unquestioned until the late sixteenth century (Lyons, and Towers, 2010). Further, Galen emphasized that nerves act as a connecting link between the brain and other organs of the body (Mubeen, and Khan, 2019, pp. 1364-1367). According to him, the substance/essence of the nerves is similar to the brain substance (*maghz dimāgh*), except that the substance of the nerves is harder (Sabatowski, et al., 2004, pp. 701-716). Also, Galen categorized nerves into two varieties, namely soft and hard nerves, which he associated with the sensory and motor functions of the nervous system, respectively. He also proposed that nerves possessed a hollow tubular structure, allowing the circulation of the psychic pneuma (*rūḥ-e-nafsāni*), or vital spirit, believed to be the primary source of vitality within the body (Avicenna, n.d., pp. 70, 494-496; Pagel, 1970, pp. 406–408; Arzani, 2002, pp. 136).

Table 1: Galen's list of seven cranial nerves (Smith, 1971, pp. 77-98)

Cranial Nerves	Galen's Description
Olfactory:	
Galen described the olfactory tracts in his anatomical accounts; however, he did not regard them as true cerebral nerves. Because of their hollow appearance, he considered them to be direct extensions of the brain rather than distinct nerves.	
I pair	Galen described the first pair of cranial nerves, the optic nerves, as converging posterior to the orbits in a configuration resembling the Greek letter chi (χ), which later gave rise to the term "chiasm." However, he believed that the fibres approached one another without actual intermixing.
II pair	The second pair, corresponding to the oculomotor nerve, was described by Galen as a "hard" or motor nerve that divided into branches supplying the muscles responsible for ocular movements.
Trochlear and Abducens:	
Galen did not provide separate descriptions corresponding to the modern trochlear and abducens nerves.	
III pair	Galen regarded the third pair, corresponding to the sensory component of the trigeminal nerve, as a "soft" nerve responsible for conveying sensation from the face and teeth.
IV pair	In contrast, the fourth pair (trigeminal motor) supplies the temporalis, masseter, and pterygoid muscles.
V pair	Galen identified the fifth pair, comprising the facial and auditory nerves, as a combined structure originating from distinct roots and performing different functions; however, he classified them together because they emerged through a common cranial foramen.
VI pair	Galen likewise described the sixth pair as a unified nerve complex consisting of the glossopharyngeal, vagus, and accessory nerves, recognizing that these components were closely associated and emerged together through a common foramen.
VII pair	Galen described the seventh and final pair as the hypoglossal nerve, primarily responsible for innervating the muscles of the tongue. He also traced certain nerve fibres to structures such as the pleura, pericardium, pharynx, larynx, stomach, other abdominal organs, and the trapezius and sternomastoid muscles.

After the decline of the Roman Empire, the center of medical scholarship gradually moved eastward, where Galen's writings were translated from Greek into Arabic. Arab and Persian scholars, particularly Avicenna, Rhazes, and other medieval physicians, not only preserved these works but also expanded upon Galenic concepts through their own observations and interpretations. By the thirteenth century, Arabic versions of Galen's treatises had been translated into Latin, thereby reintroducing this body of knowledge to European medical scholars (Singer, 1957, pp. 56-57).

2- Views of Medieval Persian and Unani Scholars

An analysis of the neuroanatomy in classical Persian and Unani literature demonstrates that the brain is a principal organ (*Uḍw-i- Ra'is*) for psychic/mental faculties (*Quwā Nafsāniyya*) and nerves are the connecting link between the brain and body. (Qarshi, 2010, p. 35) Two types of nerves serve the brain: one type is concerned with sensation i.e. afferent or sensory nerve and the other type is concerned with movement i.e. efferent or motor nerve (Avicenna, n.d., p. 70; Jurjani, 2010, pp. 87-91; Majoosi, 2010, pp. 88-91). Earlier, Alcmaeon and Herophilos have given similar descriptions in their writings (Sabatowski, et al., 2004, pp. 701-716). The sensory nerve (*a'ṣāb hissī*) carries sensory stimuli to the brain whereas the motor nerve (*a'ṣāb harkī*) carries the responses and commands of the brain out to the various muscles and effector organs (Avicenna, n.d., p. 70; Jurjani, 2010, pp. 71-76; Majoosi, 2010, pp. 88-91; Arzani, 2002, pp. 136-141; Baghdadi, 2004, pp. 83; Razi, 2007, p. 59; Rushd, 1987, p. 13; Masihi, 2008, p. 57). Further, Herophilos accurately demonstrated the course of the nerves originating from the brain (*dimāgh*) and spinal cord (*Nukhā*) (Sabatowski, et al., 2004, pp. 701-716).

Far ahead, medieval Persian and Unani scholars/physicians, especially Rhazes, Tabari, Haly Abbas, Abu Sahl Masihi, Avicenna, and Jorjani agreed with Galen and believed the nerves as sprigs of the brain that are controlled by the brain itself. According to them, nerves were classified among the simple organs, meaning structures that are uniform in composition and cannot be subdivided into dissimilar parts. Other organs included in this category were bones, cartilage, tendons, ligaments, arteries, veins, membranes, and flesh. In this context, a nerve was regarded as an A'dā' Mufrada because its essential structure was believed to be fundamentally indivisible. (Avicenna, n.d., p. 70-73; Jurjani, 2010, pp. 71-76; Majoosi, 2010, pp. 35-45, 87; Arzani, 2002, pp. 136-144; Baghdadi, 2004, pp. 75-90; Razi, 2007, pp. 83-84; Rushd, 1987, p. 44; Masihi, 2008, p. 57) In addition, the physical description and temperament of the nerves were given by medieval Persian and Unani scholars. According to them, a nerve is a white, soft, pliant structure having a cold and dry (*Bārid Yābis*) temperament which is difficult to tear. The fact that the temperament of the nerve is cold (*Bārid*), it is supported by its hardness as well as its lesser blood supply. (Zuhr, 1986, p. 210) The nerves are considered as a route for the psychic pneuma (*Ruh-i-nafsāniyya*). For this reason, the nerves are thought to be hollow, like the arteries or veins, according to Persian and Unani physicians. (Majoosi, 2010, pp. 46, 87; Arzani, 2002, pp. 136-144; Rushd, 1987, pp. 34, 44, 198; Masihi, 2008, p. 57) As the anatomy and physiology of the human body became more advanced, the notion of space for animal spiritus/ psychic pneuma (*Ruh-i-nafsāniyya*) has waned gradually. Avicenna and other contemporary scholars provided detailed descriptions of the extensive and intricate distribution of nerves throughout the body. Their classification of nerves was based not only on anatomical origin but also on functional characteristics. Accordingly, they differentiated nerves into two major categories: sensory and motor nerves (Avicenna, n.d., p. 70-73).

The cranial nerves (CN) are a set of paired nerves that arise directly from the brain. Almost every Persian and Unani scholar described only seven pairs of cranial nerves, which are listed below in Table 2 (Chagmani, 2004, p. 35).

Table 2: Number of the Cranial Nerves (*A'ṣāb-e-Dimāghi*) described in the Persian & Unani System of Medicine (USM) (Arzani A. 2002, pp. 136-244; Rushd, 1987, pp. 34, 44, 198; Masihi, 2008, p.57)

Number	Cranial nerves
I pair	*Shab-e-awwal*: ***A'ṣāb-e-ajwaf*** (Optic nerve)
II pair	*Shab-e-duwwam*: (Occulomotor nerve)
III pair	*Shab-e-suwwam*: ***A'ṣāb-e-ẕauqī*** (part of Trigeminal nerve)
IV pair	*Shab-e-chaharum*: (part of Trigeminal nerve)
V pair	*Shab-e-panjum*: (Facial nerve) and ***A'ṣāb-e-sam'ī*** (Auditory nerve)
VI pair	*Shab-e-shasshum*: (Glossopharyngeal, Vagus and Spinal accessory)
VII pair	*Shab-e-haftum*: (Hypoglossal nerve)

In the present article, elaborated views of three medieval Persian (Iranian) scholars, Rhazes, Avicenna and Jorjani are described.

A. Rhazes

Rhazes (864–930 AD), also known as Abu Bakr Muhammad ibn Zakariya al-Razi (Figure 2), is regarded alongside Avicenna as one of the most distinguished physicians of the medieval era. Renowned for his remarkable expertise in neurological localization, this Persian scholar authored Liber Continens (*Kitab al-Hawi fi al-Tibb*), one of the most influential medical encyclopedias of the medieval period (Duckworth, Lyons, and Towers, 1962, pp. 121-220). Like Galen, Rhazes recognized and described seven pairs of cranial nerves.

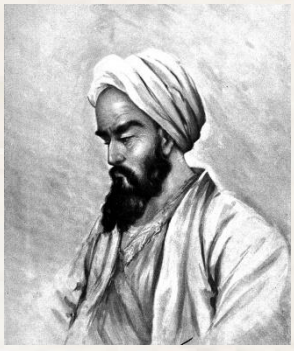

Figure 2. Rhazes (*Abu Bakr al-Razi, 2002*)

Rhazes observed that the cranial nerves emerged from the brain in paired formations and were enclosed by two membranous coverings. In *Liber Continens* (*Kitab al-Hawi fi al-Tibb*), he further explained that nerves perform both motor and sensory functions (Razi, 2007, pp. 83-84). He followed the same sequence of cranial nerve classification proposed by Galen, and this arrangement remained widely accepted until the time of Vesalius, after which later anatomists introduced further refinements to the system (Flamm, 1967, pp. 285-297; Singer, 1952; Von Soemmerring, 1778) (Table 3). Ultimately, Soemmerring established the modern classification system consisting of twelve pairs of cranial nerves (Gruner, 1973).

Table 3: Rhazes's description of cranial nerves (*A'ṣāb-e-Dimāghi*) (Masihi, 2008)

Cranial Nerves	Rhazes's Description
Olfactory:	
Rhazes considered the olfactory nerve as a part of the brain.	
I pair	He considered the optic nerve to be the first pair of cranial nerves.
II pair	The second pair of cranial nerves described by Rhazes corresponds to the modern oculomotor nerve.
III pair	Rhazes associated the third and fourth pairs of cranial nerves with components of the trigeminal nerve.
IV pair	
V pair	The fifth cranial nerve corresponded to the facial and auditory/acoustic nerves.
VI pair	The sixth cranial nerve corresponded to the glossopharyngeal nerve as well as the vagus and spinal accessory nerves.
VII pair	The seventh cranial nerve corresponded to the hypoglossal nerve

B. Avicenna

Avicenna (980–1037 AD) is widely recognized for his contributions to medical theory, although he also made notable observations in anatomy (Figure 3). Among his most important neuroanatomical contributions was the early explanation of the functional significance of the optic chiasm in binocular vision. Avicenna is credited with some outstanding explanations in the Canon of Medicine. He had given unique examples of connections between the brain and nerves. According to him, anger results in dryness of nerves, and then related emotions are exhibited subsequently (Avicenna, n.d., pp. 494-498, 504). In view of Avicenna, the brain is soft due to its fat content that aids in nurturing the tenacious nerves bit by bit. Various nerves, although harder in nature arise from the marrowy substance of the brain (*maghz dimāgh*). Avicenna further proposed that the soft consistency of the brain facilitates the swift transmission of psychic pneuma (*Rūḥ-i-nafsāniyya*) through the nerves (*A'ṣāb*) (Avicenna, n.d., p. 504; Gruner, 1973; Abu-Asab, Amri, and Micozzi, 2013, pp. 367–370). Avicenna largely adopted Galen's classification of seven pairs of cranial nerves and reproduced it in his anatomical descriptions. He also provided detailed accounts of the interconnections and relationships among different nerves (Avicenna, n.d., pp. 70-73) (Table 4).

Figure 3. Avicenna (*Choudry, 2013*)

Table 4: Avicenna's description of cranial nerves (*A'ṣāb-e-Dimāghi*) (Avicenna, n.d., p. 504; Gruner, 1973; Abu-Asab, M., Amri, H., and Micozzi, M.S., 2013)

Cranial Nerves	Avicenna's Description
Olfactory:	
Similar to Galen, Avicenna regarded the olfactory nerve as an extension of the brain rather than an independent cranial nerve. He described the olfactory bulbs as arising from two "nipple-like projections" and attributed to them the function of olfaction, or the perception of smell.	
I pair	Avicenna described the optic nerves as the first pair of cranial nerves, originating near the olfactory bulbs and deep within the anterior cerebral ventricles. He characterized these nerves as "short and hollow" structures that intersect at the optic chiasm, which he likened to the shape of a cross. According to his description, each optic nerve contains both decussating and non-decussating fibres. Avicenna also explained several functional benefits of this partial crossing of optic fibres. First, he proposed that in the event of injury to one eye, the "vital force" could be transmitted from the unaffected side to assist the damaged eye, citing the simultaneous pupillary response of both eyes as supporting evidence. Second, he suggested that the crossing enables visual impressions from both eyes to merge into a single image, whereas unequal distribution of the vital force could result in double vision, as observed in squinting. Third, he believed that the crossing allowed the optic nerves to provide mutual support to one another.
II pair	Avicenna identified the second cranial nerve as the oculomotor nerve, describing its distribution to the muscles of both eyes where it facilitates ocular movements. He characterized this nerve as soft in consistency and relatively thicker than the brain substance itself.
Trochlear and Abducens:	
Avicenna did not provide distinct descriptions corresponding to the modern trochlear and abducens nerves.	
III pair	Avicenna described the third pair of cranial nerves as corresponding to the trigeminal nerve, consisting of three major divisions. These branches were identified as the ophthalmic, mandibular, and maxillary nerves, and their areas of distribution were outlined briefly. According to his account, the first branch traverses the foramen lacerum, the second emerges through the stylomastoid foramen, and the third extends toward the orbit through the superior orbital fissure. He further noted that branches of this nerve supply the tongue for taste sensation, the cheeks on both sides, the temporal muscles, as well as the lips, teeth, and gums.
IV pair	The fourth nerve described by him is the sensory branch of the trigeminal, which is "smaller and harder" than other branches of the trigeminal because it supplies sensation to the soft palate and responsible for taste.
V pair	Avicenna described the fifth cranial nerve as comprising both facial and auditory components. The facial branch was said to accompany the course of the third nerve and was responsible for motor supply to the muscles of the face and cheeks. He compared the temporal branch of the facial nerve with the optic nerve, stating that the former is thin and firm in consistency, whereas the optic nerve is soft and thick, and differences that he attributed to the nature of the organs supplied by these nerves. The auditory branch, associated with hearing, was characterized as particularly hard in structure, which Avicenna related to its functional interaction with air, considered the lightest of substances.
VI pair	Avicenna described the sixth cranial nerve as a complex formed by the glossopharyngeal, vagus, and accessory nerves. According to his account, these nerves originate as small rootlets near the origin of the fifth nerve (facial–auditory complex), unite to form a common trunk, and emerge through a foramen situated near the lambdoid suture, corresponding to the jugular foramen. After exiting the skull, this complex divides into three distinct branches. The first branch, corresponding to the glossopharyngeal nerve, was described as supplying the pharyngeal muscles and the root of the tongue. The second branch innervated the muscles of the shoulder, while the third branch, identified as the vagus nerve, was said to pass through the "carotid foramen" and extend to the visceral organs. Avicenna further noted that the vagus communicates with the third nerve complex to provide innervation to the diaphragm, visceral peritoneum, and iliac muscles. He also gave a remarkably detailed account of the branches of this nerve complex, including the recurrent nerve looping around the aorta, while correctly observing its asymmetrical course.
VII pair	Avicenna identified the seventh cranial nerve as the hypoglossal nerve, describing it primarily as the motor nerve of the tongue responsible for its movements, whereas the sensation of taste was attributed to another nerve discussed earlier.

C. Esmail Jorjani

The Persian scholar Esmail Jorjani (Gorgani, 1042–1137 AD) (Figure 4) adopted the neuroanatomical framework established by Rhazes and Avicenna and is considered among the earliest physicians to describe the crossing of fibres at the optic chiasm along with its physiological importance (Jurjani, 2010, pp. 87-91; Shoja, et al., 2010, pp. 431-434) (Table 5).

Figure 4. Esmail Jorjani (*Zarshenas, et al., 2012*)

Table 5: Jorjani's description of cranial nerves (*A'ṣāb-e-Dimāghi*) (Jurjani, 2010)

Cranial Nerves	Jorjani's Description
Olfactory:	
Galen described the olfactory tracts in his anatomical accounts; however, he did not regard them as true cerebral nerves. Because of their hollow appearance, he considered them to be direct extensions of the brain rather than distinct nerves.	
I pair	Galen described the first pair of cranial nerves, the optic nerves, as converging posterior to the orbits in a configuration resembling the Greek letter chi (χ), which later gave rise to the term "chiasm." However, he believed that the fibres approached one another without actual intermixing.
II pair	The second pair, corresponding to the oculomotor nerve, was described by Galen as a "hard" or motor nerve that divided into branches supplying the muscles responsible for ocular movements.
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The classical texts played a pivotal role in shaping Renaissance science. In the encyclopedic works of classical Persian and Unani scholars, physicians not only conveyed a foundational understanding of anatomical and physiological subjects but also emphasized the necessity of personal observation and critical judgment in the pursuit of truth. These scholars encouraged a methodological approach that balanced reverence for authoritative texts with empirical inquiry—an ethos that significantly influenced the intellectual landscape of the Renaissance.

Throughout the sixteenth and early seventeenth centuries, traditional concepts of the nervous system continued alongside newly emerging anatomical observations. The practice of human dissection, together with careful study of classical medical texts—many preserved and interpreted by Persian and Unani scholars—contributed to a deeper and more refined understanding of neuroanatomy. Consequently, the works of Renaissance anatomists frequently integrated ideas inherited from both Greco-Roman antiquity and the scholarly traditions of the Islamic Golden Age.

Previous studies on the history of cranial nerves have largely traced a direct line from Galenic anatomy to the anatomists of the late Medieval and early Renaissance periods, often overlooking the significant contributions of Persian and Unani scholars. These scholars were not merely transmitters of Galen's work; they actively engaged with and expanded upon it through detailed observation and commentary, thereby enriching the medical corpus. Their role in preserving, refining, and ultimately reintroducing Galenic knowledge to European circles has been underappreciated.

Significantly, the impact of Persian and Unani medical scholarship continued to be recognized even during the mid-seventeenth century. In 1653, William Harvey referred to medieval authorities and cited Avicenna's concept that, although the brain itself neither sees nor hears, it governs perception and movement through the nerves, which function as extensions conveying sensory and motor activity between the brain and the body. Harvey's recognition of Avicenna's insights underscores the continuity and impact of Unani anatomical thought in shaping modern neuroanatomical concepts. Avicenna, for example, offered comprehensive descriptions of the optic, auditory, and olfactory nerves (Avicenna, n.d., pp. 70-73; Gruner, 1973; Abu-Asab, Amri, and Micozzi, 2013, pp. 367–370).

3- Samuel Thomas Soemmerrings view

Samuel Thomas Soemmerring (1755–1830 AD) (Figure 5), a pupil of the German anatomist Heinrich Wrisberg (1736–1808), completed his doctoral dissertation in 1778 entitled "*The Anatomy of the Base of the Brain and the Origins of the Cranial Nerves*". In this work, he systematically described and designated twelve pairs of cranial nerves, establishing the foundation for the terminology used in modern neuroanatomy. (Von Soemmerring, 1778).

Accordingly, the modern classification of the twelve cranial nerves was formally established by Samuel Sömmerring in 1778. This system may be viewed as a further refinement and expansion of the concepts previously described in Persian and classical Unani medical literature. (Table 6)

Figure 5. Samuel Thomas Soemmering (*Samuel Thomas Soemmering, 2007*)

Table 6: Cranial Nerves: Views of Modern, Ancient and medieval (Rhazes, Avicenna, and Jorgani) Medicine (Avicenna, n.d., pp. 490-510; Jurjani, 2010, pp. 87-91; Simon, Marečková-Štolcová, and Páč, 2011, pp. 447-452; Smith, 1971, pp. 77-98.; Masihi, 2008, p. 57; Gruner, 1973)

	Modern view	**Ancient view**	**Medieval scholars view**		
Cranial Nerves (CN)	**Samuel Thomas Soemmerring** (12 pairs)	**Galen** (7 pairs+ descriptions of olfactory lobe and optic chiasma)	**Rhazes** (7 pairs+ descriptions of olfactory lobe and optic chiasma)	**Avicenna** (7 pairs+ descriptions of olfactory lobe and optic chiasma)	**Jorjani** (7 pairs+ descriptions of olfactory tracts for the sense of olfaction, and optic chiasma)
I pair CN	Olfactory nerve	Included in the description of encephalon (an extension of the brain)	Included in the description of encephalon (butn muqaddam)	Included in the description of encephalon (butn muqaddam)	Included in the description of encephalon (butn muqaddam)
II pair CN	Optic nerve	Galen described the first pair, the optic nerves, as uniting posterior to the orbits in a configuration resembling the Greek letter chi (χ), a structure later termed the optic chiasm.	The first pair of nerves converge with one another, allowing communication between the channels of each nerve.	The first pair; goes into both eyes and gives a sense of vision.	The first pair goes into both eyes and gives a sense of vision. He also identified the crossing of fibers.
III pair CN	Oculomotor nerve	Galen characterized the second pair, corresponding to the oculomotor nerve, as a "hard" or motor nerve that divides into branches supplying the muscles responsible for ocular movements.	The second pair of nerves innervates the ocular muscles and facilitates movements of the eyes.	The second pair of nerves provides innervation to the eye muscles and assists in coordinating their movements.	The second pair; innervates most of the eyeball muscles of both eyes and hence controls the movements of the eyeball.
IV pair CN	Trochlear nerve	Not described	Not described	Not described	Not described

V pair CN	Trigeminal nerve	Galen described the third pair, corresponding to the trigeminal nerve, as consisting of both sensory and motor components. He regarded the sensory division as a "soft" nerve responsible for conveying sensation from the face and teeth, whereas the motor division supplied the temporalis, masseter, and pterygoid muscles involved in mastication.	It was considered to constitute portions of the third and fourth pairs of cranial nerves.	The third pair of nerves was described as joining with the fourth pair before dividing into four branches. These branches were said to supply the tongue for taste sensation, the right and left cheeks, the temporal muscles, as well as the upper and lower lips, teeth, and gums.	The third pair of cranial nerves was reported to unite with the fourth pair and subsequently divide into four distinct branches. These branches were believed to provide innervation to the tongue for gustatory sensation, the cheeks on both sides, the temporal musculature, and the upper and lower lips, teeth, and gums.
VI pair CN	Abducens nerve	Not described	Not described	Not described	Not described
VII pair CN	Facial nerve	Galen regarded the fifth pair, comprising the facial and auditory nerves, as a composite nerve formed from separate origins and performing different functions; however, he classified them together because they emerged through a common foramen.	It was regarded as a component of the fifth pair of cranial nerves.	Supplies areas into the palate and provides a taste sensation.	Supplies areas into the palate and provides a taste sensation.
VIII pair CN	Auditory nerve	It was described as a fragment of fifth pair of cranial nerves.	It was regarded as a component of the fifth pair of cranial nerves.	It was regarded as a component of the fifth pair of cranial nerves and was believed to innervate both ears, mediate auditory perception (ḥiss-e-samāʿat), and provide branches to the temporal muscles.	It was classified within the fifth pair of cranial nerves and was described as supplying the ears, contributing to the sense of hearing (ḥiss-e-samāʿat), and innervating the temporal muscles.
IX pair CN	Glosso-pharyngeal nerve	Galen described the sixth pair as a unified nerve complex composed of the glossopharyngeal, vagus, and accessory nerves, recognizing that these three components were closely associated and emerged together through a common foramen.	It was regarded as a component of the sixth pair of cranial nerves.	It was described as a component of the sixth pair of cranial nerves and was believed to innervate the pharyngeal musculature.	It was regarded as part of the sixth pair of cranial nerves, with branches supplying the muscles of the pharynx.
X pair CN	Vagus nerve	It was regarded as a component of the sixth pair of cranial nerves.	It was regarded as a component of the sixth pair of cranial nerves.	A component of the sixth pair of cranial nerves was described as providing innervation to the visceral organs.	One branch of the sixth pair of cranial nerves was believed to extend to and supply the visceral structures.

XI pair CN	Spinal accessory nerve	Considered as part of the sixth pair of nerves.	Considered as part of the sixth pair of nerves.	—	——
XII pair CN	Hypoglossal nerve	The seventh pair, identified as the hypoglossal nerve, was described as innervating the muscles of the tongue.	It was classified as the seventh pair of cranial nerves.	It was described as the seventh pair of cranial nerves, providing innervation to the tongue and pharyngeal muscles.	It was identified as the seventh pair of cranial nerves and was believed to supply both the tongue and the muscles of the pharynx.

Discussion

So far, the number of spinal nerves is concerned, there is no apparent difference between the concepts of Persian and Unani system of medicine and modern medicine; However, the difference between them lies in the number of cranial nerves. Persian and Unani scholars recognized 31 pairs of spinal nerves, consistent with modern anatomical understanding; however, they identified only seven pairs of cranial nerves. This difference arose because several distinct nerves were grouped together as single entities. For example, the auditory nerve was regarded as one of the branches of the fifth cranial nerve, while the vagus nerve was considered a branch of the sixth cranial nerve (Arzani, 2002, pp. 136-144). The possible reason for the differences between the opinions of Persian and Unani and modern physicians was the fewer opportunities for Unani physicians for human dissection. There is no firm evidence that they were engaged in human dissection. Therefore, it is believed that the anatomical findings of dissection in animals were applied to humans for a better understanding of structure and functions in humans. Galen dissected animals to explore the anatomy of the brain and nerves. He stated that his studies of the brain were mainly based on the apes, but he also dissected ox, sheep, and goats (Rocca, 2003). Furthermore, evidence derived from the accounts of Herophilos (335–280 BC) and Erasistratus (310–250 BC) suggests that these early anatomists may have performed human dissections (Smith, 1971, pp. 77-98.).

Conclusion

Contemporary scientific medicine is deeply rooted in the medical traditions of ancient Greek and Roman scholarship, which were subsequently preserved, refined, and expanded by medieval Persian and Arab physicians within the Unani system of medicine. Persian and Unani scholars made substantial contributions to the understanding of cranial nerve anatomy, and several of their observations were original despite remaining largely unrecognized by many post-Vesalian European anatomists. Nevertheless, the role of Persian and Unani medical literature in the advancement of medicine has often been underappreciated in modern times, partly because of limited scientific validation within contemporary frameworks. The present review compiles and analyzes detailed accounts of cranial nerves documented across ancient, medieval, and Renaissance medical traditions over nearly a millennium of anatomical scholarship.

Persian and Unani scholars put forward comments based on their knowledge and observations, then made deductions from the work they had done or had observed. Gaps in the traditional and contemporary knowledge related to terminology, approach, and methodol-

ogy might be gradually eliminated by conducting comprehensive historical reviews. Thus, an innovative hybrid methodology/concepts/discipline can be constructed by assimilation of the critical chattels of different but definitive scientific disciplines. The present study focuses on the links between different perspectives of ancient, medieval, and renaissance scholars. This article aims to bridge the gap between classical and contemporary text-making en route to scientific pieces of evidence. The revision of the classical texts did not mean abandoning one's own logical and pragmatic observation; instead, finding connections and links so that something new can be discovered.

Furthermore, the foundational ideas laid down by Persian scholars such as Rhazes (al-Razi), Avicenna (Ibn Sina), and Ismail Jurjani continue to resonate within modern neuroscience. Their systematic descriptions of cranial nerves, neurophysiological mechanisms, and diagnostic approaches—though framed in different terminologies—mirror many of today's clinical neuroanatomical insights. Modern neuroimaging, functional brain mapping, and nerve repair therapies benefit from a similar integrative approach that blends anatomical precision with physiological understanding—an approach first pioneered in Unani scholarship. As current neuroscience increasingly emphasizes interdisciplinary frameworks, personalized medicine, and historical context in the understanding of neurological diseases, revisiting classical Persian and Unani texts offers a rich, underexplored resource. Recognizing and integrating these perspectives into modern research not only fills epistemological gaps but also honors a more inclusive history of medical knowledge.

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Authors' Contribution

Sana Kauser Ateeque Ahmed contributed to the conception of the study, data collection, literature review, manuscript drafting, organization of the content, and preparation of the final manuscript. Tasfiya Hakeem Ansari contributed to the critical review of the manuscript and provided important intellectual suggestions and revisions to improve its scientific content. Osama Riyaz Ahmed assisted in manuscript editing, formatting, and language revision. Shabistan Fatma Taiyabi reviewed the manuscript critically for intellectual content and provided academic guidance. Khursid Alam Ansari supervised the overall work and provided expert guidance throughout the preparation of the article. All authors read and approved the final version of the work.

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