



# Mansur ibn Ilyas Shirazi (1380–1422 AD), a pioneer of neuroanatomy

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## Abstract

History of anatomy is as long as the history of medicine itself. Development of this basic science was not possible without the dedicative effort of those physicians and scholars who were committed to discover the mysteries of human anatomy. In this regard, Iranian scholars played an important role in the development of the anatomical sciences despite the religious limitations in their societies. Mansur ibn Ilyas Shirazi is an Iranian physician of fourteenth century who wrote the first color illustrated anatomical book, *Mansur's Anatomy*. A considerable portion of the book has been dedicated to the central and peripheral nervous system so that he could be considered as one of the pioneers of neuroanatomy.

**Keywords** Anatomy · History of medicine · Neuroanatomy · Neurology · Mansur ibn Ilyas · Persian medicine

## Introduction

The science of human anatomy, as the basis of clinical medicine, has long been considered by Iranian scientists [1]. Historical documents indicate that study of the human anatomy through animal models dates back to the nineteenth century BC at the time of the Babylonian rule in Persia (old Iran) [2]. Iranians established the basic sciences of anatomy, physiology, and pathology long before Greece. They academically

developed these sciences with the beginning of the Sassanid dynasty in third century AD and establishment of the Jundishapur University [3].

History of medicine in Iran dates back to four centuries before Christ. Some of the basic principles of medicine and hygiene had been mentioned in *Avesta*, the holy book of Zoroastrianism [4]. For instance, it has recommended keeping away the pollutions from the water and soil of the living place in order to prevent the diseases. It has also some instructions to treat the diseases with knife (surgery), medicinal herbs, or sacred words [5].

Even a long time earlier, it was Iranians that transferred their medical knowledge to the Greeks 700 years BC and receive it back through the treatises of Hippocrates two centuries later [6]. Hippocrates himself has confessed that he had learned the fundamentals of medicine from the family of “*Sina -ye Moghani*” or “*Sena*” in the medical school of Ecbatana [7].

Establishment of Jundishapur academy (271 AD) by the Sassanid King, Shapur I, is a turning point in the history of medicine. This scientific center, which is the first university of the world and the biggest one at its era, played a very important role in the progression of the medical sciences. Its golden age is during the reign of Khosrow Anushirvan (501–579 AD) when about 5000 students from various parts of the world were studying and annual international congresses were conducting there [8]. Later, its heritage was gradually transferred to Baghdad school since the ninth

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century AD, making a connection between the pre-Islamic and Islamic period in the history of medicine.

In the golden age of Islamic civilization (ninth–twelfth centuries AD), Muslim scholars used Islamic teachings to give more depth to medical sciences including anatomy; however, due to the religious limitations in dissecting Muslim corpses, they mostly used animal models and detached body parts such as limbs and eyes [9]. Many famous physicians of this period, such as Rhazes (865–925 AD) [10] and Avicenna (980–1037 AD) [11], devoted a part of their medical books to anatomy and dissection of human organs. For instance, previous investigations have revealed the discoveries of Muslim scholars in the anatomy of cardiovascular system [12, 13], pulmonary circulation [14], ocular anatomy [15, 16], and neuroanatomy [17, 18].

At the end of Khwarazmian Empire, devastating invasion of Mongol Empire happened by the army of Genghis Khan during 1219–1221 AD. It is one of the most disasteric events in the history of Iran in which up to three-fourths of Iranian people were killed and many cities, libraries, and cultural heritages were totally destroyed [19]. At that time, Chorasnia medical school was one of the most import Iranian medical schools. During its history (305–1231 AD) which was ended after this invasion, it has a great contribution in the development of science and culture in Iran [20].

After the Mongol invasion and the establishment of the Ilkhanate as the Southwestern sector of the Mongol Empire by Hulagu Khan in 1256 AD, some religious and social restrictions were eased and the dissection of corpses and writing of the illustrated books on human anatomy were facilitated [3]. During this period, Mansur Ibn Ilyas Shirazi wrote a color illustrated book on anatomy called *Tashrih-i Badan-i Insan* (Anatomy of the Human Body) in Persian.

## Mansur ibn Ilyas Shirazi (1380–1422 AD)

Mansur ibn Mohammad ibn Ahmad ibn Yousef ibn Ilyas (also known as Mansur) was an Iranian physician who was born in a scholarly family in Shiraz in fourteenth century AD. He grew up in his knowledgeable family and enriched his medical knowledge in cities of Shiraz and Tabriz. He is the author of three medical books titled as *Ghiasieh*, *Kefaye Mojahedieh* or *Kefaye Mansuri*, and *Tashrihi al-Abdan* or *Tashrih-i Badan-i Insan* (also known as *Tashrih-i Mansuri*) [21].

### Mansur's anatomy

*Tashrih-i Mansuri* (*Mansur's Anatomy*) is the first color illustrated human anatomy book which is written in the Persian language (including Arabic terms). The particularly important innovation of Mansur in this book,

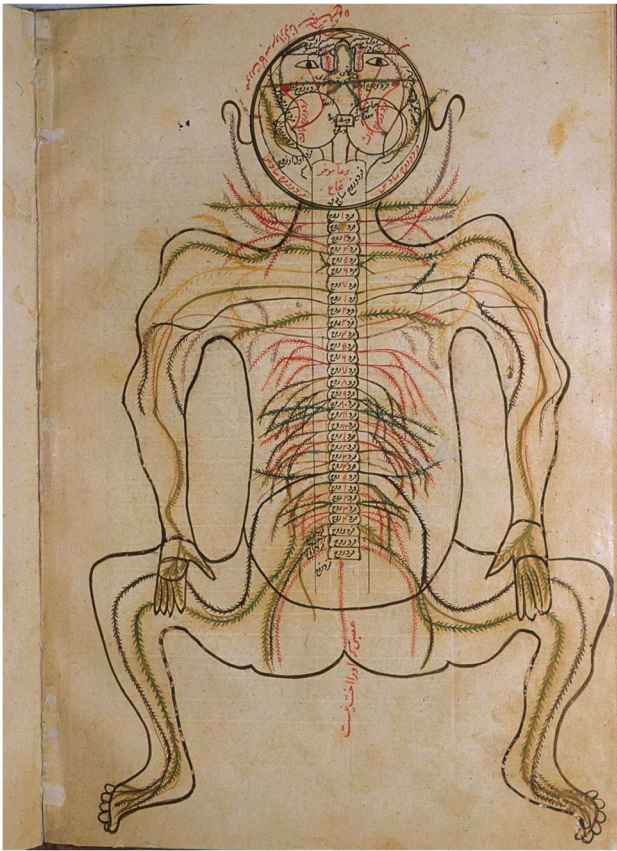
two-dimensional color pictures, not only had educational values but also was a solution to prevent plausible mistakes by future scribes of his book [22]. This book has a system-based approach toward human anatomy. After the introductory part, it has five chapters about the skeletal system, nervous system, muscular system, and circulatory system including veins and arteries followed by a final chapter concerning complex organs and fetus development [23].

By carefully examining the book chapters, one can find out that most of the content and images in this book are devoted to the anatomy of nerves so that its author could be considered as one of the pioneers of neuroanatomy. In the first chapter, which is the lengthiest part of this book, the skeletal system is described in detail including the bones of the head, neck, and spinal cord covering more than two-thirds of the pages. In the second chapter, Mansur describes the anatomy of the central and peripheral nerves. Regarding the number of the pages, this chapter is almost twice of the next chapters. Moreover, in the following chapters, the major part is dedicated to the muscles and vascular branches of the head, neck, and spinal cord. In the last chapter which deals with complex organs, he refers again to the anatomy of the brain, spinal cord, eyes, ears, and nose. Moreover, in the pictures at the end of each chapter, more color variety has been used to accurately depict the central and peripheral nerves. Therefore, it can be said that this book has a special attention to the neuroanatomy.

### Neuroanatomy in *Mansur's anatomy*

After a precise description of the skull and vertebral bones in the first chapter, Mansur explains the branches of cranial and spinal nerves in the second chapter (Fig. 1). At the beginning of this chapter, he classifies the nerves based on four features: (1) Consistency: Sensory nerves are the softest ones especially those originated from the frontal brain. (2) Shape: Some nerves are tubular (such as the optic nerves) while the others are not. (3) Function: Some nerves have only sensory functions (such as the nerve for the taste), some have only motor functions (like the nerve for the tongue movement), and some others have both motor and sensory functions (like the nerves of arms and legs). (4) Origin: Nerves are originated either from the brain (cranial nerves) or spinal cord (spinal nerves).

In the following, he describes the cranial nerves and their functions. Optic nerve as the first pair has been illustrated in green color mentioning the optic chiasm as well. Although Mansur makes mention of the Olfactory bulbs, it seems that he has missed the olfactory nerve which is currently known as the first pair of cranial nerves in modern neuroanatomy. The second pair in red color enters the orbital cavity and gives rise to branches supplying the ocular muscles. These



**Fig. 1** Illustration of the nervous system in the book of *Mansur's Anatomy*. Source: [https://www.nlm.nih.gov/exhibition/historicalanatomies/Images/1200\\_pixels/p1911b.jpg](https://www.nlm.nih.gov/exhibition/historicalanatomies/Images/1200_pixels/p1911b.jpg)

branches are in essence the Oculomotor, Trochlear, and Abducens nerves in modern anatomy.

After describing seven pairs of cranial nerves, he explains 31 pairs and one single spinal nerves painted in green, red, blue, yellow, and black. In addition, he makes mention of

some branches of nerves in visceral organs indicating his knowledge about the autonomic nervous system.

In general, Mansur's views on the anatomy of nerves are very close to those of Galen and Avicenna with some differences with the opinions of Rhazes. Like Galen and Rhazes, he categorized the cranial nerves into 7 pairs. However, despite Rhazes, he makes mention of ipsilateral optic tract. In the image of the cranial nerves, the optic nerve is drawn in green as the first pair. Unlike Rhazes who considers the path of the optic nerve to be direct, he has drawn two paths for the optic nerve: one direct and the other cross-sectional while carefully explaining the optic chiasm.

Prominent contributions of several Persian physicians in neuroanatomy have been summarized in Table 1, chronologically [24, 25]. Mansur illustrated all previous information of nervous system as a colorful detailed picture which includes seven paired cranial nerves, 31 paired spinal nerves (indicating cervical, brachial, lumbar, and sacral plexuses, separately), and autonomic nerves accompanied with its text in Persian. Although Mansur followed previous Persian scholars such as Rhazes, Avicenna, and Jorjani, he completed and modified their knowledge. In picturing his anatomical artwork, he chose system-based approach for better classification and understanding of human anatomy.

All in all, *Mansur's Anatomy*, which is one of the most famous anatomical books in the history of medicine, has made a great contribution to the progress of medicine and anatomical sciences, especially neuroanatomy [26].

## Conclusion

As the first detailed color atlas and text of human anatomy, *Mansur's Anatomy* has been used as a reference textbook for a long time. The influence of this reference book was so much so that it separated the history of anatomy into two

**Table 1** Important contributions of great Persian physicians in neuroanatomy

Rhazes	Avicenna	Jorjani	Mansur
(865–925 AD)	(980–1037 AD)	(1042–1137 AD)	(1380–1422 AD)
Localization of lesions in the nervous system	System-based (clinically oriented) approach in anatomy	Categorizing brain into forebrain, midbrain, and hindbrain	First color illustrated anatomical textbook in the Persian medicine literature
Identifying the sensory and motor nerves	Precise description of six extraocular muscles	Describing “ansa cervicalis”	System-based approach in anatomy
Introducing seven paired cranial nerves and 31 spinal nerves	Describing “trigeminal nerve”	Precise description of “optic chiasm” and “binocular vision” mentioning the ipsilateral path	First detailed color illustration of the nervous system including cranial, spinal, and autonomic nerves
Describing the “recurrent laryngeal nerve” as a mixed sensory and motor nerve for the first time	Precise description of “optic chiasm” and “binocular vision”	Describing decussation of optic nerves	Following Galen and Rhazes in considering seven pairs of cranial nerves

eras of before and after the *Mansur's Anatomy* [27]. Future in-depth investigations on Mansur's work are suggested for better understanding of his innovations and inspiring knowledge of human anatomy.

**Availability of data and material** Not applicable.

**Author's contribution** Babak Daneshfard conceived and wrote the article; Makan Sadr performed the literature review and revised the paper; Hassan Azari added important comments; Maryam Iranzadasl provided the contents and revised it with the other authors.

## Declarations

**Conflict of interest** The authors declare no competing interests.

**Ethical approval** Not required.

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