ORIGINAL ARTICLE

The Anatomy Illustration in Some of the Western and Iranian Medical Manuscripts

Abstract

Medical knowledge and its scientific and practical experience have long been important among countries with longstanding backgrounds. One of the most important branches of medical science is the science of anatomy, which has contributed to the treatment of unknown diseases and the surgery of the organs of the body. Among the medical anatomy versions, those who have used body anatomy imaging have been more successful in conveying concepts and medical education and treatment of diseases. Since the Renaissance, great painters such as De Vinci or Jan van Calkar have had a grand interest in anatomical imagery and have presented a particular style. In Iran, some medical manuscripts, such as *Mansouri's Anatomy* Book or *Akbari Medicine*, have a specific anatomy of the body. The purpose of this article is to study the anatomy of the human body in some medical versions of the West and Iran illustrated. For this purpose, several specimens of medical prescription manuscripts are selected as examples. In Western versions, the design and presentation of components of the body are very influential in the style of Greek and Roman sculpture, and the figures are statuesque. But in Persian versions, the anatomical figures have a flexible body and no contractual dry state.

Key words: Anatomy, Medicine Illustration, Western Manuscripts, Persian Manuscripts, Medicine, Human body

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Introduction

One of the most important branches of ancient medical knowledge is the science of anatomy, which has had a great impact on the development of theoretical and practical sciences and has helped to the treatment of unknown diseases and organ surgery. To this objective, many medieval physicians and sages in the Middle Ages and the Renaissance tried to remove religious and academic restrictions and to turn to the dissection of the human body instead of the dissection of the animal.

Anatomy Illustration

The history of anatomy return to thousands of years ago to the Egyptians. The study of anatomy has begun at least in 1600 BC: from the date of Papyrus known as *Edwin Smith Papyrus*. "The Edwin Smith Papyrus is an ancient Egyptian medical text, named after the dealer who bought it in 1862 and the oldest known surgical treatise on trauma".[1] "This document, which may have been a manual of military surgery, describes 48 cases of injuries, fractures, wounds, dislocations and tumors. It dates to Dynasties 16-17 of the Second Intermediate Period in ancient Egypt, c. 1600 BCE".[2] The Edwin Smith papyrus is unique among the four principal medical papyri in existence today.

Homer, wrote some epic poems that still exert their charm including aspects of anatomy. From this point, the development of anatomical terminology accelerated. Amongst many others, Hippocrates and his medical students in the 5th century BCE and later Aristotle in the 4th century BCE belonged to those who inspired the creation of the Library and School of Alexandria at the end at the 4th century BCE. Greek physicians were famous all over the Hellenic world, which included Asia Minor. "Homeric works were written in "Homeric Greek", an archaic form of Ionian Greek, probably during the 8th century BCE and thus more than three centuries after the Trojan War. Homer had already mentioned Asklepios in the Iliad (Books 2, 4, 11 and 14) but as a great healer only".[3] Furthermore "An analysis of Homer's Iliad shows that a great number of anatomic references are contained in the text. Anatomic structures mentioned in the poem include: encephalon, spinal cord, trachea, lung, heart, liver, bowel, urinary bladder, tongue, diaphragm, cranial bones, cervical vertebrae, clavicle, acetabulum, ankle joint, aorta and external carotid artery. This suggests that a conspicuous complex of anatomic notions was included in the Homer's age culture".[4]

In the Indian subcontinent, the Ayurvedic treatise was of particular importance. "The word "*Ayurveda*" is Sanskrit

1-Wilkins, 1992: 98.
2- Allen, 2005: 124.
3- Sprumont, 2016: 249-280.
4- www.pubmed.ncbi.nlm.nih.gov/9312729/.

meaning knowledge of life and longevity".[5] "*Ayurveda* is a system of medicine with historical roots in the Indian subcontinent".[6]

"The central theoretical ideas of *Ayurveda* developed in the mid-first millennium BCE, and show parallels with *Sāṅkhya* and *Vaiśeṣika* philosophies, as well as with Buddhism and Jainism".[7] It is stressed that "Balance is emphasized, and suppressing natural urges is considered unhealthy and claimed to lead to illness".[8] The design of the *Ayurvedic human* anatomy is done in some manuscripts that are written alongside the limbs, sometimes inside the limbs human (Figure 1).

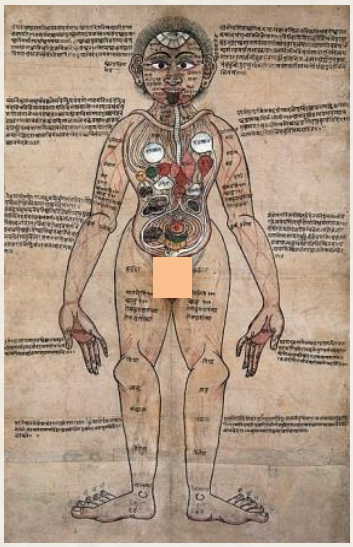

Figure 1. Human Ayurvedic Anatomy Design, Nepal, 18th century.

The science of traditional human anatomy in Tibet flourished in the 17th century because of being knowledgeable in medicines and drugs constructing monasteries' medical colleges and writing several eminent medical texts. Among these "perhaps most striking was a set of 79 paintings, known as tangkas, which were intended to illustrate a comprehensive four-volume medical treatise called The Blue Beryl. Created between 1687 and 1703, these paintings are vibrant pieces of educational art that interweave practical medical knowledge with Buddhist traditions and Tibetan lore—depicting such things as the use of omens and dreams for making diagnoses, hundreds of medicinal herbs and medical instruments, and diagrams of human anatomy".[9]

Desi Sangye Gyatso (1653–1705) was the sixth regent of the 5th Dalai Lama (1617–1682), who founded the School of Medicine and Astrology called Men-Tsee-Khang on Chagspori (Iron Mountain) in 1694 and wrote the *Blue Beryl* (Blue Sapphire) treatise (Figure 2).

5- Gregory, 2001: 36.
6- Meulenbeld, 1999: 78.
7- Basham, 1976: 18.
8- Wujastyk, 2003: 45.
9- www.the-scientist.com

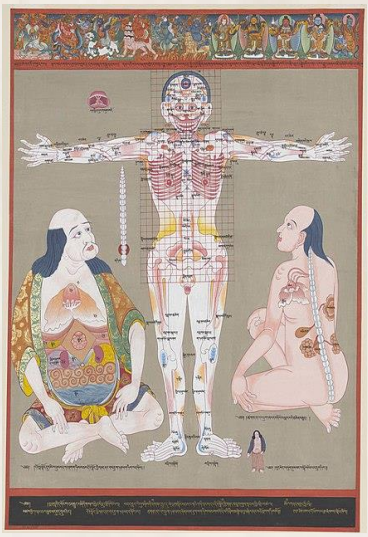

Figure 2. Anatomy of the vulnerabilities of the human body, Atlas of the anatomy of the body of Braille Blue by Desi Sangye Gyatso.

Human anatomy in some Western manuscripts

The dissection of the body was initially accompanied by reluctance as well as religious and even traditional restrictions. "From the third century BC to the twelfth century, human anatomy was usually taught through books and animal autopsies".[10] "For decades, the prevailing view has been that when the knowledge of human anatomy can be read and learned from the experiences and resources of individuals such as Galen, there is no need to describe and split the human body".[11] The following bears the importance of learning anatomy: "In the twelfth century, at the same time as the establishment of universities in Italy, Emperor Frederick II forced medical students to take courses in anatomy and human surgery".[12] Mondino de Luzzi (1270-1326) was one of the first and few anatomists and professors of surgery who personally perform autopsies and body examinations for the purpose of training.[13] His name is recorded as the first person to dissect the human body in Western Europe in 1315 (Figure 3).

Among the famous medical books, we can name *The Fasciculus Medicina*, which is a collection of medical knowledge attributed to *Johannes de Ketham*, the German physician routinely associated with the *Fasciculus*, who was neither the author nor even the original compiler but merely an owner of one of the manuscripts. The original Latin text was published in Venice in 1491 with six schematic images. The Metropolitan Museum of Art version is an Italian translation published three years later with four engravings on wood (added), reflecting the influence of Giovanni Bellini

10- Siraisi, 1990: 84.
11- Nutton, 2004: 138.
12- Crombie, 1967: 181.
13- Persaud, 2014: 55.

and Andre Mantegna, one of the most original artists of the period. *The Fasciculus Medicina* (1491) is the first illustrated medical book in the West. The Latin articles and illustrations in this volume provide insight into Western European medical knowledge and deal with the medical culture of the late fifteenth century in the Italian edition published in 1493 (Figure 4).

Figure 3. Mondino de Luzzi, "Lesson in Anatomy", originally published in Anathomia corporis humani, 1493. Courtesy of the National Library of Medicine.

Figure 4. A view of the teaching and dissection training hall of the body, from Fasciculo di medicina that was published in 1493-1494, published in Latin in Venice, woodcut, The Metropolitan Museum.

"In four wooden gravures, the artist depicts four subjects: the importance of knowledge-based medicine, the emergence

of laboratory medicine, Hippocratic lessons based on patient observation, and the emerging revolution in anatomy".[14]

This book has been published as the first illustrated medical treatise, especially with images such as: Urine Chart, Diagram of Vessels for Cupping, Pregnant Woman, Wound Man and Zodiac Man.

During the Renaissance, due to scientific, religious, and artistic developments, and for a short time, the views of some designers and painters, who themselves had studied anatomy and autopsy, were drawn to the subject of descriptive body illustration, such as Leonardo da Vinci.

Leonardo da Vinci

In 15th century, a new understanding of perspective enabled more realism and revolution in art. This was one of the most important developments of the Renaissance and caused some artists to have a new interest in the human form. Certainly one of the greatest was Leonardo da Vinci (1452-1519), who was famous for his paintings. As a young artist, he was licensed to dissect human corpses at Milan Medical School. Leonardo's obsessive interest was not only in art, but also in the design of the human body, the physical mechanism of the body.

"In 1489, Leonardo began a series of anatomical designs depicting the ideal shape of the body. This was done intermittently for more than two decades. During this time he used his anatomical knowledge to perform his artistic works and designed many skeletal structures, muscles and organs of humans and other vertebrates that he had dissected".[15] "Leonardo first believed in Aristotle's concept of anatomy but later studied Galen's writings and took a more empirical approach and took a more experimental approach that ultimately led Galen to abandon himself altogether and rely entirely on his own direct observations".[16]

According to Vasari (1511 to 1574), "he was one of the first that began to illustrate the problems of medicine with the doctrine of Galen, and to throw true light on anatomy, which up to that time had been veiled in the thick and gross shadow of ignorance. And in this he found marvelous aid in the brain, work and hand of Leonardo, who made a sketchbook with drawings in red chalk retouched in pen and ink: the bodies that he dissected with his own hand were drawn with the greatest diligence"[17] (Figures 5 and 6).

Leonardo had an intuitive perception of form. When he described the body, he could understand in a very fluent way how the different parts of the body fit together and work together.

14- DiMaio et al, 2006: 187-196.
15- Boas, 1970: 120.
16- O'Malley, 1983: 89.
17- www.mpg.de.

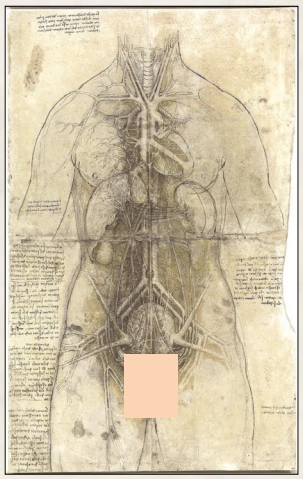

Figure 5. Leonardo da Vinci, the cardiovascular system and principal organs of a woman, c.1507-09, Windsor, Royal Collections.

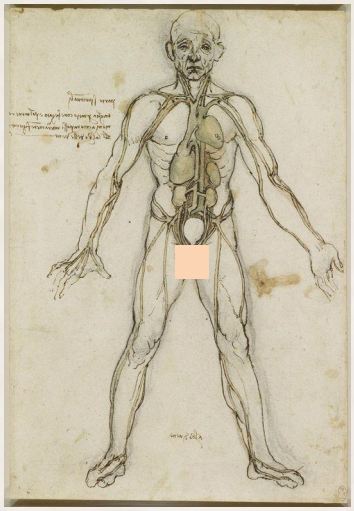

Figure 6. Anatomical study of the body of a man standing in front of the viewer, with long legs and outstretched arms, to show the internal organs of the heart, lungs and arteries of the original, Leonardo da Vinci, the Royal Collections of Queen Elizabeth II.

Andreas Vesalius

Andreas Vesalius (1514-1564) is an anatomist, physician and prominent Belgian physician. Vesalius is often referred to as the founder of modern human anatomy. He is the author of one of the most important books on the descriptions of the human body: “On the Fabric of the Human Body” (De Humani Corporis Fabrica Libri Septem), published in 1543. This book is originally a collection of his lectures and classes at the University of Padua and includes topics from some of the textbooks of the time, his experiences, and some of his

personal teachings, but the main part of it was related to the experiments and descriptions of the exact organs that he had done. Vesalius's book is a masterpiece in anatomical illustration (Figure 7).

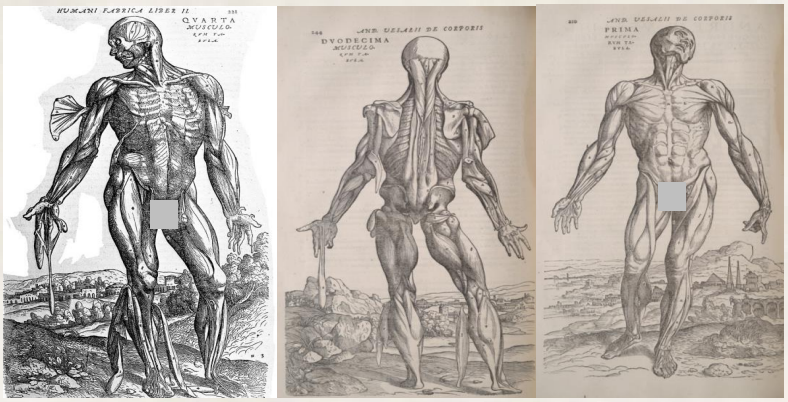

Figure 7. Illustration of the human anatomy, book of "On the Fabric of the Human Body" by Andreas Vesalius, Gravures attributed to Jan van Calcar, Second edition, 1555.

Although this book is essentially an anatomy textbook, but Vesalius provides a more complete explanation than previous authors and corrects many of Galen's anatomical errors. It may be said that this book, for the first time in Western medicine, provides an accurate interpretation of the muscles, bones, limbs, and nerves. The presence of more than 200 gravure paintings on wood is remarkable for their meticulous detail, magnificence, and direct connection to the text. Vazari considers the anatomical gravure of Vesalius to be the work of Jan van Calcar (1499–1546) Renaissance painter and scientific illustrator. Of course, a few others can be considered illustrators of the book, including Vesalius himself or Titian.

Bartolomeo Eustachi

Bartolomeo Eustachi (1500 or1514-1574) of "Eustachian tube" fame was a sixteenth-century contemporary of Vesalius. "He spent most of his professional career in Rome where he taught anatomy, performed autopsies at hospitals, and carried out dissections. Eustachi's most famous contribution to anatomy was not available until 140 years after his death. By 1552 Eustachi had drawn and engraved 47 plates showing the human skeleton and muscles, but only eight plates were printed with text during his lifetime. Eventually all of the plates ended up in the Vatican Library. In the eighteenth century the papal physician, Giovanni Maria Lancisi, added explanations to the previously unpublished plates and published the complete set with text. While not as artistically

stylish as Vesalius's work, Eustachi's volume is sometimes more accurate. If his entire collection of plates had been published ten years after Vesalius rather than 140 years later, it is probable that the two would have been honored as cofounders of modern anatomical study"[18] (Figure 8).

The Renaissance gave rise to a new movement in medical science. One of the areas that emerged with the support of the healing monks of the monasteries was surgery Surgeons, who were not involved with the church, experienced and practiced medicine under the teachings of physiology and Gallon's anatomy (Figure 9). Vesalius questioned the views of Galen and challenged his contemporaries. One of his antagonists was Eustachi. He tried to defend Galen and expand his views.

Figure 8. The body's descriptive design, Bartolomeo Eustachi's book, shows the nerves in this form from the back, the unusual shape of the legs and knees allows the nerves to be seen well.

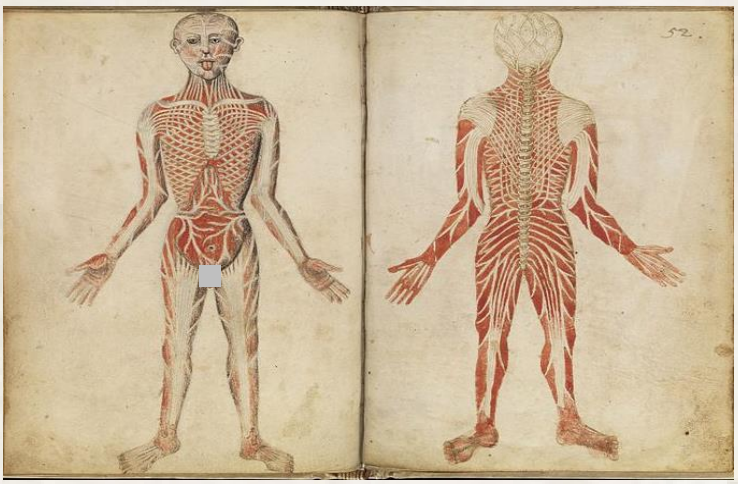

Figure 9. Human and Spinal Anatomy Chart, Claudius, Pseudo-Galen,

18- www.exhibits.hsl.virginia.edu.

At the time, an industrial small house was being built to complete the Eustachi anatomical engraving in 1522. These gravures were found in the Vatican Library in the late 18th century. Pope Clement XI gifted them to Giovanni Maria Lancisi, an Italian physician, epidemiologist and anatomist, and he published them in 1714 in his own notes.

Juan de Valverde

Juan Valverde de Amusco (1525-1587) was born Spain and studied medicine in Padua and Rome under Realdo Columbo and Bartolomeo Eustachi. He published several works on anatomy. Juan de Valverde became the most important anatomist in Spain during his lifetime.

"Valverde's most famous work was *Historia de la composicion del cuerpo humano*, first published in Rome, 1556. All but four of its 42 engraved copperplate illustrations were taken almost directly from Andreas Vesalius's *De humani corporis fabrica*. Vesalius bitterly commented on Valverde's plagiarism, accusing him of having performed very few dissections himself. Occasionally, however, Valverde corrected Vesalius' images, as in his depictions of the muscles of the eyes, nose, and larynx. One of Valverde's most striking original plates is that of a muscle figure holding his own skin in one hand and a knife in the other, which has been likened to Saint Bartholomew in The Last Judgment (Michelangelo) of the Sistine Chapel".[19]

"The original illustrations were most likely drawn by Gaspar Becerra (1520–1570), a contemporary of Michelangelo, and the copperplate engravings are thought to have been carried out by Nicolas Beatrizet (1507-1570), whose initials "NB" appear on several of the plates"[20] (Figure 10).

Many of these plates reproduce illustrated images of Vesalius, and others, with significant scientific advances, are originally attributed to Gaspar Becerra, who was clearly influenced by Michelangelo (Figure 11).

The human Anatomy in Some Iranian Medical Manuscripts

It may be said that the first Muslim's medical information about anatomy science be obtained from the translation of the Galen's texts, however, Galen himself believed that Hippocrates was more skilled in human anatomy than he was. In addition to the various medical books he has written, he has outlined the principles of anatomy as a branch of medicine and theology for future physicians. According to the writings of the ancients, a total of about 12 books and treatises by Galen remain in the science of description, which were later

19- Choulant, 1962: 205-208.
20- www.nlm.nih.gov. Accessed in 13/06/2019

used by physicians.[21]

21- Kasiri, 1388: 2.

Figure 10. Image of the flayed muscle man holding his skin and flaying knife by Gaspar Becerra in Historia de la Composicion del Cuerpo Humano (1556) by Juan Valverde de Amusco.

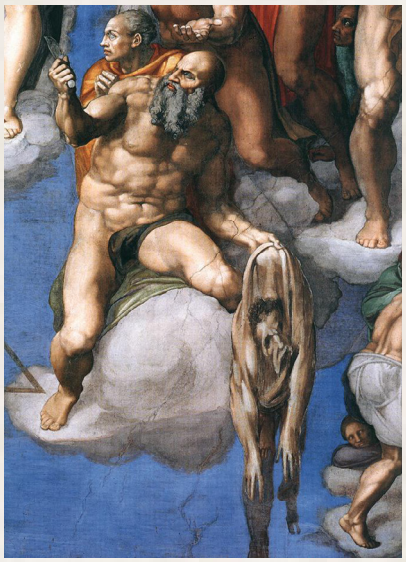

Figure 11. Santo Bartholomeus holding the knife of his martyrdom and his flayed skin – Michelangelo, The Last Judgment, 1536-1541, The Sistine Chapel, Vatican.

In this article, for the Iranian Islamic Medical Treatises section, three famous books with human anatomy images have been selected: Akbari's Medicine (*Tebb-al-Akbar*), *Zakhīrah-i Khvārazm'Shāhī* and *Mansuri Tashrihi*.

Akbari Medicine

"*Akbari Medicine*" or "*Tibb-al-Akbar*", the work of the sage Muhammad Akbar Arzani, is a complete course in the science of diseases and cognition and treatment of diseases, which was written in 1112 AH. *Muhammad Akbar Arzānī* was a celebrated Sufi physician of the late 17th and early 18th century. He composed many medical treatises, including the *Qarābādīn-i Qādirī*, a pharmacopoeia written as a tribute to Sayyid 'Abd al-Qadir of Gilan (1165/561) who was the founder of the Sufi order of which *Arzānī* was a member.

Six anonymous anatomical drawings occur on folia 554-559 at the end of a volume containing *Akbari Medicine* (d. 1722/ 1134) in an undated copy probably made in the 18th century. The paper, on which these figures are drawn, however, is distinct from that of the main text, though similar in many respects. The illustrations appear to be unrelated to the accompanying text and to draw upon Indian and early-modern sources.

"One full-opening of the manuscript, folia 554b-555a, contains two full-figure anatomical illustrations, one of a female and one of a male. The female figure is of a pregnant woman. The woman holds back a flap of abdominal skin to expose the gravid uterus, while in her other hand she appears to hold a plant rather than a part of the body, though that could be interpreted as referring to the female genitalia. Surrounding the figure are portrayals of individual organs: at the top, two hearts; lower right, the lungs; something unidentified in lower left (labeled the opening of the vagina) (Figure 12).

Figure 12. Image of a man and a woman holding their internal organs, Tibb-al-Akbar, by Muhammad Akbar, known as Muhammad Arzani (d. 1722/ 1134).

The male figure has his abdomen and chest opened to reveal the internal organs. His right hand holds a second set of genitalia, and there is a sketch of the liver and gallbladder in the upper left corner. The artistic conventions employed in the production of these two illustrations clearly indicates Western India as a place of production. The 16th to 18th century European convention of picturing partially-dissected bodies as if they were alive, often with the obliging cadaver holding up parts of their own body for further inspection, can be seen here transferred to the Indian subcontinent. The anatomy of the exposed organs reflects indigenous Indian concepts as well as some medieval Galenic anatomy".[22] European conventional illustrations of the sixteenth to eighteenth centuries, with images of detached limbs that appear to be alive, and often with a corpse showing parts of its body for further examination, has influenced on the medical illustration of the Indian subcontinent. The example of this can be seen in these paintings.

Zakhīrah-i Khvārazm'Shāhī

"*Ismā'īl ibn Muḥammad al-Ḥusayn Jurjānī* arrived at the court in the Persian province of Khvarazm in the year 1110/504 when he was already a septuagenarian. There he became a court physician to the governor of the province, *Khvārazm'Shāh Qutb al-Dīn Muḥammad ibn Nushtigin*, who ruled from 1097 to 1127. It was to him that he dedicated his most comprehensive and influential work, the Persian-language compendium *Zakhīrah-i Khvārazm'Shāhī*".[23] This book was the largest medical book in Persian written to date.

"Jurjani's most important role in the development of medical science in Iran, in addition to his importance as a physician, is the writing of the greatest and oldest medical works in Persian. Until the Jurjani's era, the sources of medical knowledge of the Islamic period were generally in Arabic, both translations of the works of Greek scientists and the writings of even Iranian physicians".[24]

There are two Diagram comparable to the "six picture series" or "Alexandrian series" pasted or bound in Persian manuscripts of the "*Zakhīrah-i Khvārazm'Shāhī*. Their design style is very similar and comparable to the images of Mansuri Tashrihi (Figure 13).

Tashrihi Mansuri

Most of his reputation was in the knowledge of anatomy, pharmacology and medicine. Ibn Ilyas, for the first time in the Islamic world and civilization, has traced accurately anatomical pictures, and also brought together archeological dis-

22- www.nlm.nih.gov. Accessed in 2/08/2019
23- www.nlm.nih.gov. Accessed in 13/06/2019
24- Anonymous, 2009: 4604.

cussions of the womb and fetus in the field of women's descriptions. The date of the book "*Tashrih al-badan*" is 1396 AD/799 AH. It seems that before Mansur bin Mohammad Shirazi was not a typical anatomy book illustrated.

Figure 13. Diagram comparable to the "six picture series" or "Alexandrian series" pasted or bound in Persian manuscripts of the "Zakhīrah-i Khvārazm'Shāhī" ("Treasure of Khvārazm'Shāhī"), Iran, watercolour, with pen and ink ; image 25.9 x 17 cm, Wellcome Library.

"From this physician, a book titled *Tashrihi Mansuri* (Persian language) has survived in Persia, which was presented to the governor of the Persian Gurkani, Pir Muhammad ibn Jahangir (c. 1374 - 22 Feb. 1407), with the names of the Enlightenment. (*Tashṛiḥ-i bel-Tasvir*), *Tashṛḥ-i badan-i insān, Sharh al-Badan* and *Resaleh-fi-elm-Tashrīḥ* are also known and have one introduction and five chapters In the description of bones and nerves, muscles and vessels".[25]

"It seems that Leonardo da Vinci was the first to revolutionize the science of describing the human body using anatomical design and illustration; but Mansur Shirazi is the first physician to write the first medical manuscripts illustrated anatomy in a new style, despite religious restrictions on the description of the human body and its imaging, and its anatomical images, while having descriptive texts, also offer a novel style to shows anatomy. No complete anatomical depiction of the human body in the Islamic world has been found before the medical treatise of Mansur".[26]

Even if Mansur's anatomical treatise is not considered the first description of the human body, undoubtedly, it is the first colored atlas of the body to ever be created.

25- Savage, 2007: 147-159.
26- Taheri, 1397: 63-64.

Conclusion

The anatomical illustration of the human body has been the great importance in Western and Iranian medical books. These medical books are evaluated in two methods: one in terms of scientific power and advanced knowledge and the other in terms of visualization and visual representation of the body, internal organs and its compatibility with the descriptive text. In the Western version, anatomical images are made in the classical sculptural style of ancient Greece and Rome and influenced by the Renaissance. A man who rests on one leg in a conventional contracted manner and represented his inner limbs. The head and body are realistically drawn. In the book of Mansuri Tashrihi, the body's anatomical display style is made of a full-length stand and humans are flexibly bent at the knees, and heads can be easily raised. It's hard to say that the designs are realistic because they're all in a weird style and without a sense of depth. It does not apply with the Akbari medicine manuscript, as the male and female anatomy images are painted with precision and natural details.

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