Original Article

Medicine-art interaction in the development of modern anatomy education in Iran: focusing on the Post-Dār al-Funūn Era

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Abstract

This study examines the collaboration between art and science in the history of modern anatomy education in Iran, particularly in the era following the establishment of Dār al-Funūn (1851). Using a historical-analytical approach and citation network analysis of primary sources, we trace the evolution of anatomical illustration from imitation of European texts to original creation. Our findings highlight the pivotal role of European physicians, such as Jakob Eduard Polak, in introducing modern anatomy and visual aids at Dār al-Funūn. We identify the publication of Kālbod-Shenāsi-ye Towṣifi (Descriptive Anatomy, 1944–1950 CE) as a key milestone, marking the first major physician-artist collaboration to produce original anatomical illustrations in Iran. However, the subsequent increase in reliance on foreign resources led to a decline in indigenous production, thereby representing a missed opportunity to preserve a unique scientific-artistic heritage in medical illustration in Iran. Ultimately, this trajectory reveals that, unlike the European Renaissance, where the mutual interest of physicians and artists in understanding human anatomy drove innovation, medical illustration in Iran was primarily propelled by physicians to meet educational needs.

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Introduction

In the global context, the Renaissance marked a profound scientific-artistic revolution in which leading figures such as Leonardo da Vinci and Michelangelo transcended the boundary between artist and scientist (1, 2). Da Vinci, who dissected more than thirty human and animal bodies, produced hundreds of meticulous anatomical drawings that were centuries ahead of their time (3). Furthermore, the revolutionary collaboration between physicians and artists—exemplified by Andreas Vesalius and Jan van Calcar in the preparation of the 1543 book *De Humani Corporis Fabrica* (On the Fabric of the Human Body)—is considered a prime example of the complete integration of art and science (2). Its exact and detailed illustrations revolutionized the teaching of anatomy and shifted medical knowledge from a reliance on flawed ancient texts toward direct observation and scientific visualization (4).

Despite the undeniable impact of art on the advancement of anatomy during the European Renaissance, this topic has not been sufficiently investigated in the history of modern medicine in Iran. While Iran did produce notable pre-modern anatomical illustrations—most prominently the first illustrated anatomy book in the Islamic world, Tashrīḥ-i Manṣūrī (1390 CE)—these works were schematic and not based on direct anatomical observation. A significant research gap exists in understanding how modern anatomical education in Iran transitioned from these traditional illustrated texts toward scientifically accurate, observation-based medical visualization. This study examines the contribution of art to the development of modern medicine in Iran following the establishment of Dār al-Funūn in 1851 CE, focusing on the roles of artists and art-science collaboration in this transformation.

Methods

The present study employs a historical-analytical approach to examine the role of artists in the development of modern anatomy education in Iran. Primary sources were gathered through citation network analysis from available literature, archival collections, and museum holdings, including illustrated anatomical textbooks, instructional documents, and

educational materials. The examined sources spanned from the medieval period through the twentieth century, with particular focus on resources associated with Dār al-Funūn and the University of Tehran's Faculty of Medicine. Each identified anatomical text was subjected to detailed examination of both textual content and visual representation, including authorship attribution, the origin and provenance of illustrations, artist identification, and the artistic techniques employed.

A critical aspect of the analysis involved determining the originality of illustrated content by comparing Iranian anatomical illustrations with contemporary European sources. Each work was situated within its historical context to identify patterns in the transmission of anatomical knowledge and the evolution of medical illustration practices. Special attention was paid to documenting instances of physician-artist collaboration and tracing the development of indigenous scientific-artistic cooperation over time in Iran.

Background of Medicine and Anatomy Teaching in Iran Before Dār al-Funūn

Anatomical knowledge in Iran, as in Europe, was for extended periods based on the descriptions of Galen (129–216 CE), which were derived from animal dissection, including monkeys, pigs, and goats (5, 6). Great physicians of the Islamic Golden Age, such as al-Rāzī, Ibn Sīnā (Avicenna), ʿAlī ibn ʿAbbās al-Ahwāzī, and Ibn al-Nafīs, also primarily repeated these classical descriptions and did not perform direct dissection (7-9). Religious and cultural restrictions prevented dissection of the human body, and all anatomical instruction was entirely descriptive and textual, without any visualization or visual documentation (7).

A significant turning point in the history of anatomy in Iran began with the work of Manṣūr ibn Muḥammad ibn Ilyās Shīrāzī (1380–1422 CE), who authored the *Tashrīḥ-i Manṣūrī* (The Anatomy of Mansur) as the first illustrated anatomy book in the Islamic world (10). This book comprises five chapters, each illustrated with a full-page image; however, the photos were schematic, abstract, and inaccurate, designed merely for better comprehension of the descriptive content rather than based on direct observation (10). The identity of the painter of these works is unknown, and the images were primarily influenced by Eastern and local pictorial traditions.

The Safavid period (1501–1736 CE) coincided with the European Renaissance and the

publication of Vesalius's revolutionary work, De Humani Corporis Fabrica (1543). However, Iran regrettably missed the golden opportunity to synchronize with the scientific transformations of the West. Despite extensive research, we could find no evidence of modern European anatomy being introduced to Iran during this period, and thus the tradition of adopting from the Tashrīḥ-i Manṣūrī continued. Lāhījī Ashkūrī's eleventh-century work Risāla dar Hay'at wa Tashrīḥ was copied almost exactly from Manṣūr's text; the images remained inaccurate and schematic (11). Nevertheless, artists such as Reza Abbasi (1565–1635 CE) flourished during this period (12). Abbasi directed Iranian painting toward realism and created new currents of individuality in the Isfahan School (12, 13). Although not connected to medical science at the time, this artistic movement may have laid the foundations for future scientific visualization and art-medicine collaboration.

The lack of concurrent anatomical advancement in Iran was likely due to a combination of various factors. These included cultural and religious prohibitions against human dissection, political and regional events such as the fall of the Safavid government and subsequent disruptions that limited access to resources, and a lack of scientific exchange with Europe (14). Additionally, the traditional medical education system institutionally resisted innovations (7).

The Establishment of Dār al-Funūn and Early Transformations in Medical Education

The establishment of Dār al-Funūn in 1851 CE by Mirza Taqi Khan Amir Kabir marked a pivotal moment in modern science education in Iran (15, 16). This institution laid the groundwork for introducing modern medical knowledge from Europe and, by teaching various sciences, fostered collaboration between physicians and artists. As the country's first modern higher education institution, Dār al-Funūn designed its educational structure based on European models, with initial instruction conducted by European academics (17). In the period immediately following its establishment, education at the medical school was conducted in two divisions: traditional medicine and European medicine. Traditional medicine was taught based on Ibn Sina's *Canon* and the book *Sharh-i Asbāb-i Nafīsī* by Mirza Ahmad Tabib Kashani, while European medicine was presented by European physicians (17). This dual approach provided a suitable environment for collaboration between European and Iranian physicians, with gradual emphasis on teaching modern methods.

Pioneers of Modern-Style Anatomy Education in Iran

Jacob Edward Polak, an Austrian physician, entered Iran in 1851 at Amīrkabīr's invitation (17, 18). Polak became the first official academic of modern medicine and anatomy at Dār al-Funūn (18). He revolutionized the teaching of anatomy by introducing a modern European curriculum (17). This included moulages, preserved specimens, complete skeletons, anatomical atlases, and charts (see Figure 1) (17). He established a new dimension of visual education previously absent in Iran. Galay, one of the European teachers at Dār al-Funūn, began teaching descriptive anatomy in 1323 AH (Islamic lunar calendar) and, by utilizing his painting skills, made a significant contribution to the effective transmission of descriptive anatomical teachings, presenting an example of artist-physician collaboration (17). Louis André Ernest Cloquet (1818–1855), son of the famous French anatomist Hippolyte Cloquet, was Nāṣir al-Dīn Shah's personal physician. He never formally taught at Dār al-Funūn, but privately instructed a number of physicians and played an important role in transmitting his father's experiences to Iranian physicians (19).

Figure 1. Anatomical chart for teaching internal organ anatomy at Dār al-Funūn (20)

Polak's Role in Modern Medical Education through the Book "Tashrīḥ-i Badan-i Insān"

Polak's first medical work, entitled *Tashrīḥ-i Badan-i Insān* (Human Body Anatomy) was

initially written in German and translated into Persian by Mirza Mohammad-Hossein Afshar, published on 25 Rajab 1270 AH (April 22, 1854 CE), constituting the first modern anatomical instructional text in Persian (18). This book was published in only 100 lithographed copies and, like other anatomical books of the period, was purely descriptive and devoid of illustrations. The limited number of printed copies restricted student access, so students began hand-copying the book for their studies. A number of these manuscripts included basic, inaccurate images similar to those in Ilyas Shirazi's Tashrīḥ al-Abdān. This indicated the continuity of traditional schematic illustration alongside the introduction of modern knowledge.

Polak, who initially taught with the assistance of a French translator, decided to learn Persian for better instruction and more direct communication with students, and after one year, began teaching in Persian. Polak's rapid acquisition of the Persian language, coupled with his collaboration with Mirza Mohammad-Hossein Afshar, facilitated the creation of a modern medical terminology (18). This laid the foundation for modern terminology that directly impacted the production and translation of anatomical visual texts (18).

The First Official Human Dissection for Student Education at Dār al-Funūn

One significant historical achievement of this period was the performance of the first official dissection by Polak in 1232 AH (approximately 1853 CE) on the corpse of his Austrian colleague, whose death was suspected to be murder, conducted at the request of his survivors in the presence of medical students at Dār al-Funūn (18). This historical event, which took place despite cultural and religious resistance, paved the way for practical anatomy education and demonstrated the breaking of traditional prohibitions.

Another significant milestone in Persian medical education occurred in the third decade of the 12th century AH, with the donation of Barnéoud's corpse. Barnéoud, a French language instructor at Dār al-Funūn, had made an extraordinary arrangement before his death. He sold his body to the medical school and designated the proceeds as capital for establishing a library in Tehran (17). This donation enabled the first official university dissection session in Iran (17). The event marked a crucial social and cultural shift in Persian attitudes toward anatomical dissection. For the first time, formal educational dissection gained acceptance within the

institutional framework of Persian higher education.

The following section discusses the illustrated anatomical texts authored during this period.

Anwār al-Nāṣiriyyah

Authored by Mohammad ibn Abd al-Sabur Khu'i Tabrizi (known as Ḥakīm Qubūlī or Ḥakīm-Bāshī) in 1272 AH (1855 CE), *Anwār al-Nāṣiriyyah* is considered the first illustrated modern anatomy book in Persian. This book had a three-volume structure with anatomical, physiological, and pathological content and contained 56 illustrations. The first volume was devoted to anatomy and comprised three main sections: a complete description of body organs, a dissection of different parts in tabular form, and illustrations of body parts at the end of each section. However, our thorough investigation shows that this book is actually a precise Persian translation of the Ottoman work *Mir'āt al-Abdān fī Tashrīḥ A'ḍā' al-Insān* (authored in 1820 CE). Its anatomical diagrams correspond precisely to those in the Ottoman book as shown in Figure 2—even the numbering within the images is identical to the Turkish version, and in some cases the Turkish labels and diagram legends are retained (21). Although this book was chronologically and contextually suitable for teaching at Dār al-Funūn, no direct evidence has been found that it was actually used there. It can therefore be concluded that it was prepared primarily to enrich Nāṣir al-Dīn Shāh's personal library and to serve as a key medical reference textbook.

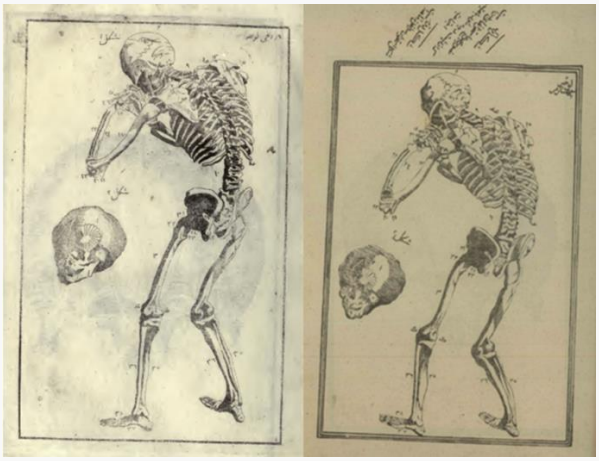

Figure 2. Skeletal anatomy [left: Mir'āt al-Abdān fī Tashrīḥ A'ḍā' al-Insān, 1820; right: Anwār al-Nāṣirī, 1855] (20, 22)

Mir'āt al-Abdān fī Tashrīḥ A'ḍā' al-Insān (Mirror of Bodies in the Anatomy of Human Organs), authored by Ṣānīzāde Mehmed Atāullah Efendi (1771–1826) and published in 1820 CE,

constituted the first printed illustrated anatomical work in the Islamic world and Ottoman-Turkish medicine. The textbook created a bridge between traditional Islamic medicine and modern European medical knowledge. Ṣānīzāde was the son of the Ottoman Empire's chief physician (Hakīm-Bāshī). He authored this work after studying in Padua, Italy, and mastering Latin, French, and Italian. However, Ṣānīzāde copied anatomical illustrations extensively from European sources (21). Specifically, 46 of the 56 images were adapted from Jean Palfyn's Anatomie Chirurgicale (1650–1730), and the remaining nine images came from other established anatomists, including Albinus, Vieussens, Haller, and Duverney (21). Despite this appropriation, Mir'āt al-Abdān brought two fundamental innovations to Ottoman medicine: 1) It was the first printed book in Ottoman-Turkish medicine, providing broader access to medical knowledge, and 2) Its illustrations differed from traditional two-dimensional miniatures, as they were drawn in a hyperrealistic perspective with precise anatomical details, which makes them historically significant (21).

Jawāhir al-Tashrīḥ

Jawāhir al-Tashrīḥ (Gems of Anatomy), authored by Mirza Ali Khan Hamedani, is a comprehensive Persian anatomical work that was published in 1304 AH (1888 CE) by the printing house of Dār al-Funūn school in Tehran (23). Archival documents from Golestan Palace as displayed in Figure 3 indicate that the book's content was derived from French medical sources. These documents reveal the production process of the book's images. The photography took place at the "Photography Studio of Dār al-Funūn" from European anatomical textbooks. Mirza Abdullah Qajar assisted in this process, and the photographs were subsequently converted to lithographic stones. Since Mirza Ali Khan Hamedani was a distinguished professor at Dār al-Funūn, and the school’s printing house published the book (23). It can be considered a primary source for teaching anatomy at the medical school.

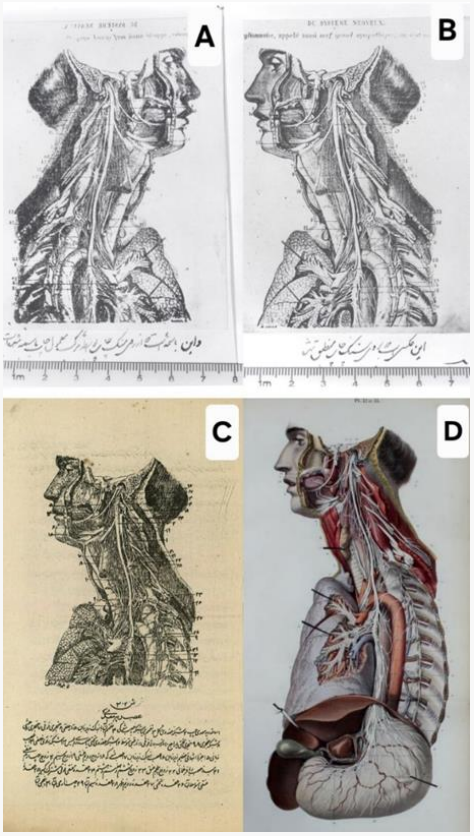

Figure 3. A: Image prepared and printed using the lithographic stone. B: Photographed image from the primary source by Mirza Abdullah Qajar, later transferred to the lithographic stone. C: Image from Jawāhir al-Tashrīḥ. D: Image from Neurologie et Esthésiologie (Neurology and Sensory Studies) by Hirschfeld and Leveillé, 1866. (photos A and B were obtained from the Golestan Palace by Ali Mirjalili, and photos C and D were photographed from the original books) (20, 24)

"Tashrīḥ" by Ali Bakhsh Mirza Qajar

Tashrīḥ (Anatomy) (13th to early 14th century AH) is one of the illustrated medical texts from the Qajar period. The author, Ali Bakhsh Mirza Qajar, was an active translator of the Naseri era, and this work is probably a translation from French. On the first page of the specimen found in the National Consultative Assembly Library, his name is mentioned as the translator. The illustrations in this book appear to have been drawn in black and white with pencil from the images of the original reference book in Figure 4, but the illustrator of the book has not been identified. This work presents an example of efforts to transfer European scientific content in the process of introducing modern medicine to Iran.

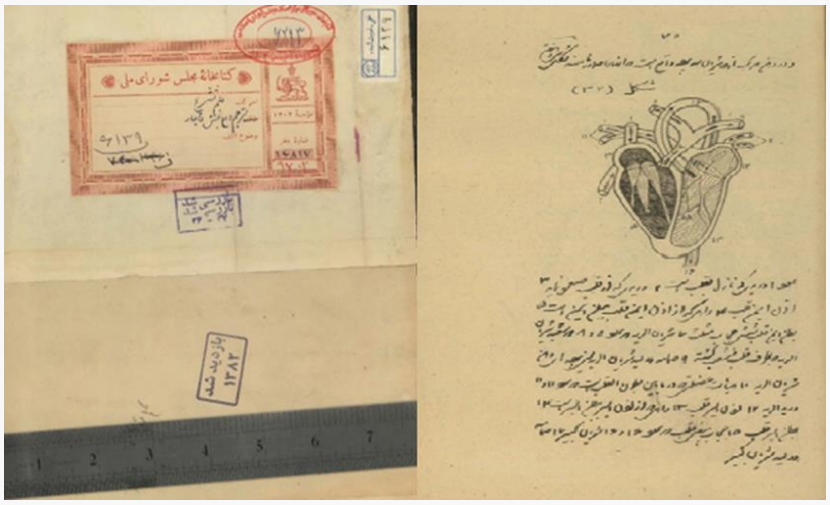

Figure 4. Tashrīḥ by Ali Bakhsh Mirza Qajar [left: first page of the book where Ali Bakhsh Mirza Qajar's name is mentioned as translator; right: anatomical illustration of the heart drawn with pencil](20)

Mir'āt al-Badan

Mir'āt al-Badan (Mirror of the Body) was authored by Hussain Ali ibn Haji Mirza Khan Razmara and published by lithographic printing in Tehran at the Dār al-Funūn Press in 1328 AH (approximately 1910 CE) (25). While the illustrations were adapted from European anatomical atlases, the book's historical significance lies in its use of a layer-by-layer teaching method with illustrations similar to Vesalius's *Epitome as presented in Figure 5* (25, 26) For this reason, the presence of images such as general skeletal views, torso and limb muscles, vessels, and internal organs has made *Mir'āt al-Badan* one of the important illustrated educational medical sources in Iran that was used by academics and medical students for years.

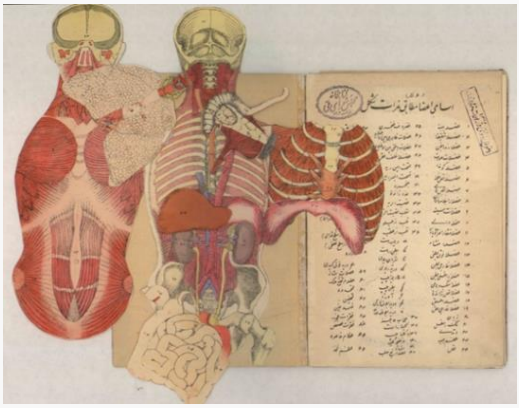

Figure 5. The book Mir'āt al-Badan: Teaching through layer-by-layer anatomical illustrations(25)

Familiarity with Modern European Art

Sani' al-Mulk and Kamal al-Mulk are two pivotal figures in the transformation of Iranian painting who altered the course of Iranian art by introducing modern European styles. Mirza Abu al-Hasan Ghaffari, known as Sani' al-Mulk (1229–1283 AH), the uncle of Kamal al-Mulk and the first Iranian artist formally trained in Europe, established Iran's first painting school after his return from Italy and—by synthesizing Iranian and European traditions—introduced psychological realism into Persian portraiture (27). Muhammad Ghaffari, known as Kamal al-Mulk (1224–1310 AH), after studying at Dār al-Funūn and traveling to Europe, consolidated academic realism in Iran and, by founding the School of Decorative Arts, paved the way for a new generation of artists who combined realistic technique with scientific precision (28). Among Kamal al-Mulk's prominent students who contributed to scientific illustration were Reza Shahabi (1280–1358 AH) and Akbar Najm Abadi (1278–1373 AH), all of whom produced illustrations for the *Kālbod-Shenāsi-ye Towṣifi"* (Descriptive Anatomy), textbook of the Tehran University, Faculty of Medicine (29, 30).

Establishment of the University of Tehran and Anatomical Science Formalization

In 1935 CE (1352 AH), the University of Tehran was established through the merger of existing higher-education institutions, including Dār al-Funūn, and its Faculty of Medicine inaugurated the Department of Anatomy as the first step in institutionalizing modern medical education (31). The first official dissection hall at the University of Tehran was inaugurated on 15 Bahman 1313 SH, thus becoming the university's first dedicated building and providing a modern facility for the preservation and dissection of cadavers (32). During this period, anatomical science achieved full academic recognition, with standardized teaching methods, development of coherent curricula, and creation of modern laboratory facilities among its major accomplishments.

Dr. Amir-A'lam: Leader of the Transformation in Anatomy Education

Dr. Amir Khan Amir-A'lam (1261–1340 SH), a graduate of the Faculty of Medicine of Lyon, France, played a pivotal role in transforming and institutionalizing modern anatomy education in Iran (see Figure 6 for a photo of Amir-A'lam) (33). Upon his return from France in 1283 SH, he

was appointed Professor of Anatomy at the Dār al-Funūn Medical School. As the first Iranian academic of modern anatomy, he taught anatomical subjects for over thirty years, establishing the foundation for scientific anatomy education in Iran based on European standards (33). When the University of Tehran was established, Amir-A'lam was appointed head of the Avicenna Complex and played a key role in the design and establishment of dissection halls and educational amphitheaters (33).

One of his most significant works was the nine-volume textbook called "*Kālbod-Shenāsi-ye Towṣifi"* (Descriptive Anatomy), which had a profound impact on anatomy education in Iran. It was produced under his supervision and the management of Manouchehr Hakim, and through the collaboration of several other academics from the Faculty of Medicine (34).

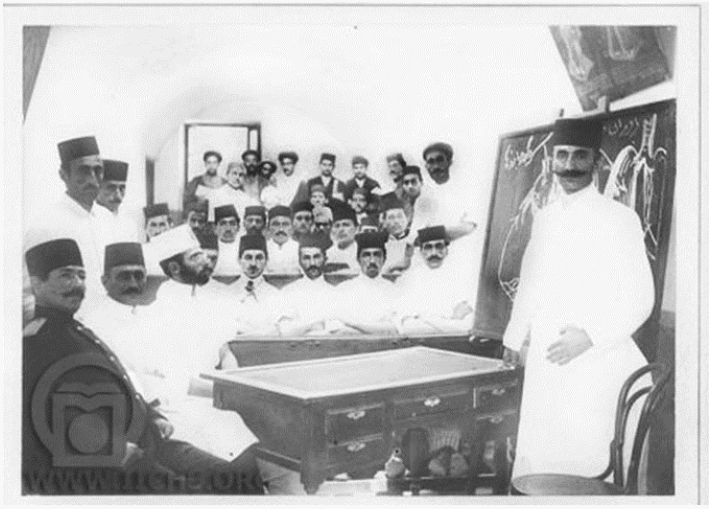

Figure 6. Amir A'lam, instructor of anatomy, medical students, and a diagram of the anatomy of the lungs and heart on the blackboard (photo obtained from the Golestan Palace) (20)

The Apex of Convergence: The Book "Descriptive Anatomy"

Kālbod-Shenāsi-ye Towṣifi (Descriptive Anatomy), produced under the supervision of Amir-A'lam and managed by Manouchehr Hakim, was authored and published in nine volumes between 1323 and 1329 SH (1944–1950 CE). It is the first comprehensive illustrated Iranian anatomy textbook and is considered unique since it was a product of a direct collaboration between physicians and artists (34). The authorial team for this unparalleled work included the most eminent physicians of its time: Amir-A'lam, Manouchehr Hakim,

Ne’matollah Keyhani, Abolghasem Najmabadi, and Nasrullah Niknafas. Manouchehr Hakim, who played a pivotal role in authoring and assembling the team, was a distinguished student of Henri Rouvière (1876–1952), the prominent French medical doctor and anatomist at the University of Paris, and utilized his consultation and guidance during the book's preparation (34). The artistic and medical illustration of this project was undertaken by skilled artists such as Reza Shahabi, Akbar Najmabadi (both students of Kamal al-Mulk), and Fakhr-eddin Abedini (student of Reza Shahabi), Farid A’lam (a relative of Amir-A’lam and a third-year medical student), and Germaine Landois-Hakim (the French wife of Manouchehr Hakim). Using modern painting and drawing techniques, they created precise, scientifically accurate anatomical images that were also of high artistic quality as displayed in Figure 7 (34). One of the unfortunate episodes in the history of medical illustration in Iran was a planned collaboration between Amir A’lam and Ja’far Petgar (1299–1384 SH/1920–2005 CE), one of the first art students of Kamal al-Mulk’s School of Decorative Arts and the founder of the first private painting academy in Tehran (35). Unfortunately, this collaboration did not come to fruition due to inevitable disagreements. However, evidence of its initiation exists in the form of detailed anatomical drawings created by Petgar as evidenced by Figure 8. Given the hyperrealistic quality of these surviving drawings, it can be inferred that Iranian artists possessed extraordinary potential for precise scientific illustration (this information is based on oral history recounted by Ja’far Petgar's son, director of the Petgar Foundation).

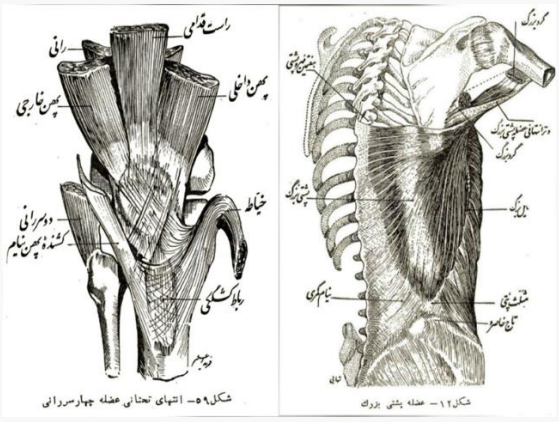

Figure 7. Examples of precise illustrations from the book "Descriptive Anatomy" (34)

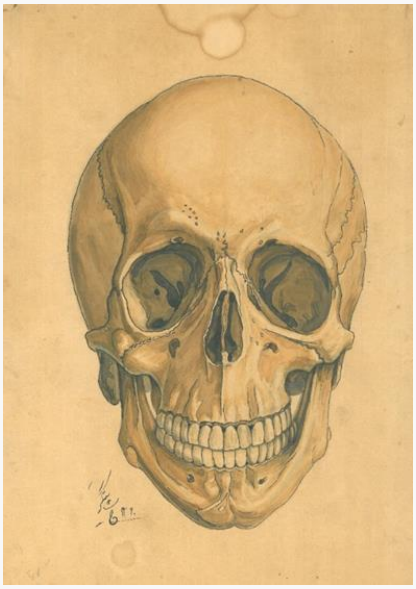

Figure 8. Painting of a skull by Ja’far Petgar, 1320 SH (c. 1941 CE) (20)

The Second Generation of Iranian Anatomy References and Foreign Sources Entry

Continuity of the Indigenous Illustration Tradition

Following the success of Amir-A’lam’s “*Descriptive Anatomy*,” a second generation of Iranian anatomy books emerged, primarily based on the same indigenous tradition of illustration. Hossein Hekmat's “*General Anatomy*,” published around 1360 SH (c. 1981 CE), is considered one of the most influential anatomy books of the contemporary period in Iran. With its modern pedagogical approach and use of appropriate images, it was used as a primary textbook in many of the country's universities (36). Concurrently, Mostafa Mostaghimi's *Descriptive Anatomy* also became a significant resource during this period, gaining a special place in the country's medical education through its detailed, systematic anatomical explanations (37). The anatomy book series by Bahram Elahi, published from 1370 SH (c. 1991 CE), which served as a primary teaching resource in Iranian universities for a long time, predominantly used illustrations from Amir-A’lam's *Descriptive Anatomy* or European sources, indicating a discontinuity in the trend of independent anatomical illustration (38).

The Entry of Foreign Anatomy References and Increasing Dependence

Concurrent with the decline in the production of indigenous resources, the importation of foreign anatomy books accelerated, and *Snell's Clinical Anatomy* was designated as the official reference

and the primary textbook for anatomy teaching by the Ministry of Health (39). *Netter's Atlas of Human Anatomy*, with its precise and artistic color illustrations drawn by Frank H. Netter (40), and *Gray's Anatomy* (41). As the most classic anatomical reference in the world, it gained a special status in Iran's medical universities. The entry of these foreign resources, despite their scientific advantages, gradually increased Iranian medical education's dependence on Western illustrations and concepts, creating an environment conducive to the decline in the production of indigenous resources.

An Example of Physicians' Influence on Artists' Anatomical Education: Keyhani's "Artistic Anatomy"

One of the rarest examples of the reciprocal interaction between art and anatomy in Iran is a book titled *Anatomy for Artists* (*Anātomī-ye Honarī*) by Ne'matollāh Keyhani. Authored by a specialist anatomist for the purpose of teaching realistic anatomy to artists, it stands as a unique instance of the fusion of science and art (42). Keyhani, a collaborator of Amir-A'lam in authoring the *Descriptive Anatomy* textbook, explains in his preface, "Historically, Iranian artists had made little use of anatomical principles and had grown distant from nature. However, with the emergence of a realist movement in the history of painting led by great masters such as Kamal al-Mulk and his pupils, familiarity with anatomical principles became necessary." He argues that "the artisan who draws the human form must learn the precise points of anatomy well, and for an artist's novel idea to manifest in true design and color, they must seek help from science" (42).

Reciprocal Impact of Art and Science in Iran and the Dār al-Funūn Legacy

Historical analysis demonstrates that artistic advancements in Iran directly influenced medical education: the introduction of realistic painting styles, the establishment of art schools, and the cultivation of skilled artists all enhanced scientific illustration. The Dār al-Funūn legacy was unparalleled in this process because it not only facilitated the entry of modern sciences but also fostered collaboration between art and science, creating a sustainable model for modern education in Iran whose impact endures to the present day. The golden age of this interaction occurred from the 1920s to the 1950s, when the collaboration between Amir-A'lam and his team of specialist physicians and Kamal al-Mulk's pupils in producing *Descriptive Anatomy* provided an extraordinary example of

Iran's capacity to generate indigenous scientific–artistic resources.

Achievements, Challenges, and Missed Opportunities

The principal achievements of this period include the authoring of Amir-A'lam's *Descriptive Anatomy* as the first comprehensive Iranian work of its kind; the successful collaboration between physicians and artists in producing scientific resources; the creation of precise Persian anatomical terminology that remains in use today; and the establishment of a tradition of scientific illustration within the Iranian culture. However, the challenges and missed opportunities encompass the discontinued collaboration between Amir A'lam and Ja'far Petgar, which could have revolutionized medical illustration; the increasing dependence on foreign resources after the 1950s and the concurrent decline in indigenous production; and the lack of supportive policies for domestic scientific resource creation, which not only overlooked the nation's artistic capacities but also paved the way for a loss of scientific autonomy.

Comprehensive Analysis and Future Significance

The development of anatomical illustration in Iran followed a trajectory fundamentally different from that of the European Renaissance. In Europe, the quest for realism often drove artists to pursue anatomical studies independently, directly shaping scientific visualization. In contrast, Iran's modern engagement with anatomical illustration was primarily a physician-led, institutional response to educational needs, particularly after the founding of Dār al-Funūn. This distinction is crucial: while European art and science co-evolved with a degree of autonomy, in Iran, artists were commissioned to serve predetermined scientific objectives. The subsequent decline in local production and increased reliance on foreign texts prevented the development of such collaborations between art and science in Iran.

Understanding this unique historical dynamic is critical for the future. As new technologies such as virtual reality and 3D modeling redefine medical education, Iran has an opportunity to develop indigenous educational tools. Rather than simply adopting foreign platforms, Iran can leverage its rich artistic heritage and the historical precedent of the physician-artist collaboration to develop culturally specific, technologically advanced anatomical resources. This approach would not only meet

contemporary scientific standards but also revitalize a unique scientific-artistic tradition, ensuring its relevance in the digital age.

Conclusion

This study reveals a significant historical gap in Iranian anatomical illustration following Manṣūr ibn Ilyās's fourteenth-century Tashrīḥ-i Manṣūrī, with no primary indigenously illustrated textbooks produced until the modern era. The interim period was characterized by a reliance on works that adapted or copied European illustrations. A pivotal shift occurred after the establishment of Dār al-Funūn, culminating in the physician-artist collaboration that produced Descriptive Anatomy (1944–1950)—the first modern Iranian anatomy textbook with entirely indigenous illustrations. This achievement underscores the profound potential of art-science collaboration, a model whose value extends across diverse scientific fields and remains a cornerstone of Iran's cultural and scientific heritage.

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20. Courtesy of Associate Professor Ali Mirjalili, private personal collection, Auckland, New zealand, 2025; used with permission.

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