Historical review

Anatomy across centuries: From ancient Greeks to modern innovations. The merit and significance of autopsies today

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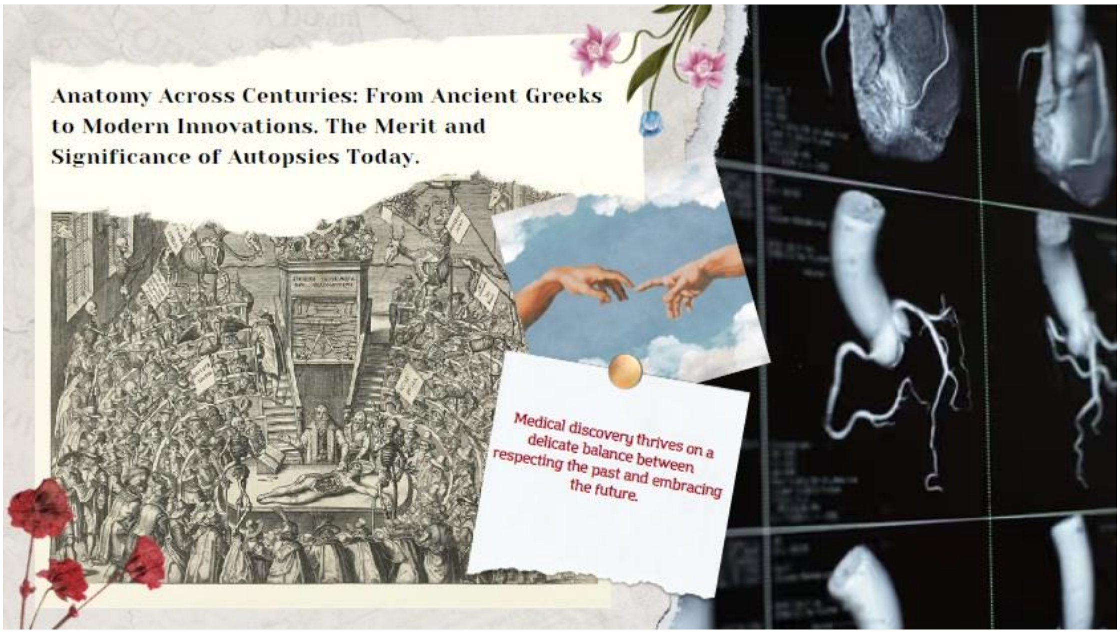
Abstract
The article discusses the history of anatomy in the context of its development from antiquity to modern achievements, including the latest visualization technologies. The influence of historical anatomical research on the understanding of the structure and functions of the human body is analyzed.
The article discusses the problems that arise from the attractiveness of the latest imaging technologies and emphasizes the enduring value of practical autopsy experience. We should not forget that the essence of medical practice goes beyond digital simulations - it is rooted in the tactile exploration of human tissues and organs.
In a world characterized by rapid technological progress, it is extremely important not to forget about the invaluable knowledge gained through centuries-old autopsy traditions. The complex dance between tradition and innovation has shaped the trajectory of our understanding of anatomy, pathology, and medical intervention. From the ancient Greeks who laid the foundations for anatomical research to the advanced technologies of today that offer us unprecedented insights into the human body, the path of medical discovery thrives on a delicate balance between respecting the past and embracing the future.
The field of cardiovascular medicine is a vivid illustration of the symbiotic relationship between tradition and innovation. Autopsies, with their timeless significance, constantly guide doctors and researchers to improve interventions and surgical techniques. The intricate details revealed during autopsies have paved the way for remarkable achievements, from elucidating the pathogenesis of diseases to improving surgical procedures.



Keywords
History of anatomy; autopsy; dissection; Diocles of Carystus; Vesalius; 3D technologies.
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Introduction
Human anatomy is the study of the human body's structure. The term "anatomy" originates from a Greek word that signifies "to cut up." The science of physiology goes hand- in- hand with anatomy. The term physiology is derived from the Greek word—meaning “the study of nature”, which manifested in its function. These two concepts are interdependent and inseparable from each other because the structure of each organ depends on its function and vice versa (1).

Global knowledge of anatomy, physiology, and pathology, along with the terms we possess today, has a complex, sometimes tumultuous and ambiguous history spanning thousands of years. It is the result of the dedicated work of countless devoted anatomists from the past who meticulously dissected, depicted on charts, described, and named numerous parts of the body.

Historical accounts indicate that the exploration of anatomy traces back to as early as 1600 BC in Greece when sacrificial human bodies were examined. An uncommon papyrus, famously known as the Edwin Smith Surgical Papyrus (named after the archaeologist who acquired it), provides insight into the heart and its vessels, the liver, spleen, kidneys, hypothalamus, uterus, and bladder, while also detailing blood vessels originating from the heart (2, 3) (Fig.1).

In this article we discuss the history of anatomy in the context of its development from antiquity to modern achievements, including the latest visualization technologies. The influence of historical anatomical research on the understanding of the structure and functions of the human body is analyzed.

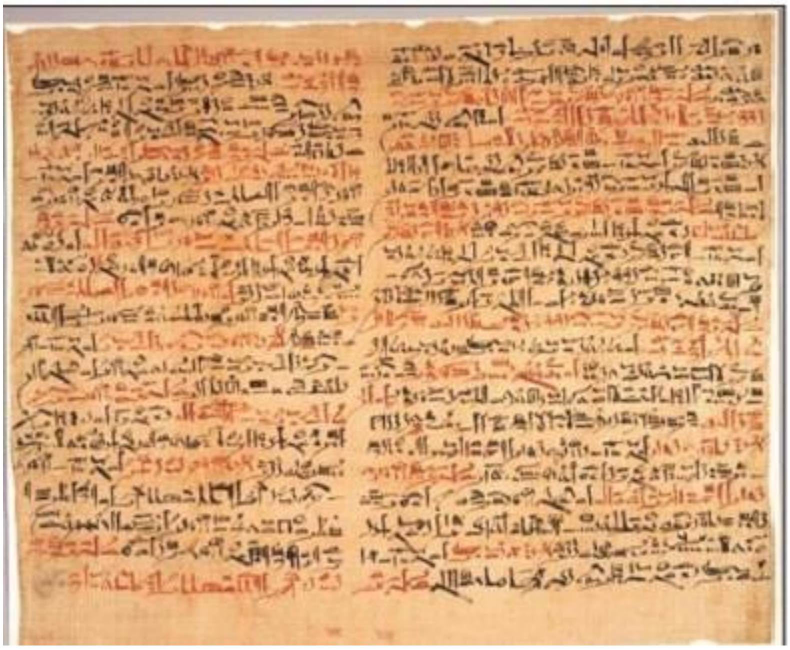

Figure 1. Edwin Smith Papyrus 1500 BC
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The early development of anatomy

It was in Ancient Greece that anatomy was first considered a science. Numerous works of Greek philosophers had a significant impact on further scientific thought. The first real dissections for the study of disease were carried out in about 300 BC.

According to some sources, Diocles of Carystus (probably 375–300 BC), also known as Diocles the Physician, from the island of Euboea, is credited with pioneering the first studies of anatomy through animal dissection (Fig 2). As a philosopher and trailblazer in the field of medicine, he is often compared to Hippocrates in terms of his dissecting prowess. His extensive works spanned a wide spectrum of subjects, including animal anatomy, dietetics, physiology, embryology, and medical botany (4, 5).

Diocles was known for writing medical works in Attic Greek, rather than the Ionic Greek that was common at the time. Unfortunately, few fragments of his works have survived to this day, so we can only imagine the extent of his profound knowledge. Diocles is considered to be the first person to use the term "anatomy" and the inventor of the Diocles spoon, a tool designed to remove weapons or projectiles from the human body (6-8).

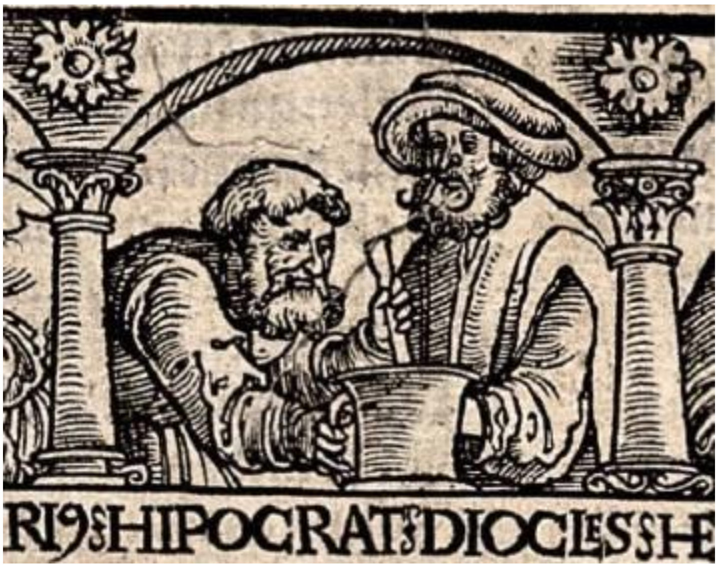

Figure 2. Hippocrates and Diocles of Carystus at a mortar and pestle. Woodcarving showing Hippocrates and Diocles of Carystus.
(Republished from https://hekint.org/index.php?Option=com_googlesearch_cse&n=30&view=googlesearchs&s=Diocles under CC BY licence rules)

Another prominent Greek anatomist who systematically dissected animals was Aristotle. He created one of the earliest known anatomical illustrations depicting the male genitourinary system. His in-depth anatomical studies are detailed in several books, including Parts of Animals and History of Animals. Aristotle described the superior and inferior vena cavae as coming from the largest compartment on the right and the aorta from the intermediate one (2, 9).

Regarding the gastrointestinal tract, Aristotle provided a remarkably precise depiction of the esophagus, which he described as extending from the mouth, passing through the diaphragm, and terminating in the highly expandable stomach. Drawing comparisons, he likened the human stomach to that of a dog and the lower part of the abdomen to that of a hog due to its wide nature. He also mentioned a fatty, broad, and membranous mesentery covering the bowels (omentum) and its blood supply. Aristotle identified various sections, such as the jejunum, cecum, sigmoid flexure, and rectum (9). Despite his remarkable achievements, Aristotle propagated certain erroneous theories concerning anatomy. One notable example is his conviction that intelligence was located in the heart, not in the brain (10). Aristotle asserted that the brain "is larger in men than in women" . . . because the "region of the heart and of the lung is hotter and richer in blood in man than in any other animal, and in men than in women." He even reported finding more sutures in the skull of men than women because "the explanation is again to be found in the greater size of the brain, which demands free ventilation, proportionate to its bulk." He described a small cavity in the center of the brain linked by a membrane filled with veins but the brain itself was considered to be without blood because of which it was cold to the touch ("for of all the parts of the body, there is none so cold as the brain"). He claimed that the brain was essentially the pacemaker of the heart as it controlled each heartbeat (9).

The ascent of anatomy

Herophilus, often called the "Father of Anatomy," lived around 300 BC. Despite the loss of his writings, his extensive dissections led to numerous anatomical discoveries. He acknowledged the brain as the center of intelligence, not the heart, and described the delicate arachnoid membranes as the seat of the soul. He is credited with identifying the circular Herophili and the furrow in the fourth ventricle.

Herophilus recognized nerves from the brain as sensory organs and differentiated them from those related to voluntary movement. He also described the coverings of the eye, named the duodenum, and attributed the heartbeat to arterial pulsation. Other contributions include knowledge of the pulmonary artery, mesenteric vessels, uterus, and the discovery of the epididymis. Interestingly, he may have accepted female pupils, like Agnodice, who had to disguise herself as a man to study medicine (11, 12).

Herophilus with his student Erasitratus founded the Medical School in Alexandria with the first "department of anatomy" in history. The apprentice later rose to prominence as an anatomist, and Galen frequently cited him for his observations, such as the following: "The vein arises from the part where the veins have their origin and penetrates to the sanguineous (or right) ventricle (of the heart), and the artery (or pulmonary vein) arises from the part where the veins have their origin, and penetrates to the pneumatic (or left) ventricle of the heart". This claim demonstrates how near he was to understanding blood circulation so long before Harvey (13, 14). Later on, the rulers of Alexandria expelled all Greeks which ended this famous Medical School, along with the school of anatomy and autopsy (15).

Galen (ca. 130–200 BC) made a significant impact through his research on the circulatory system. He was the first to distinguish between venous (dark) and arterial (bright) blood. His extensive anatomical experiments on animal models greatly enhanced our comprehension of the circulatory, nervous, and respiratory systems (16, 17).

The darkened horizons of anatomy

In the following centuries, Greek anatomical knowledge almost disappeared in Europe. After the persecution of Alexandrian scholars and the Roman conquest of Egypt, Alexandria became part of the Roman Empire. The museum was destroyed, and the library was looted and burned. As a result of the persecution, Greek scholars scattered within the Empire, but Greek physicians still dominated the field of medicine. It was not until around 60 B.C. that a medical school called the "Asclepiadic sect in physic" was established in Rome by Asclepiades of Bithynus (c. 120–30 B.C.) (9, 15).

During this time, anatomy faced a decline because dissection was forbidden, and this situation persisted until the late Middle Ages. Fortunately, anatomical knowledge was preserved in the Islamic world. Many ancient texts from Greece, Rome, Persia, and even India were translated into Arabic by Yuhanna ibn Masawaih (Masue) and six generations of the Bukhtishu family, among others, and later translated into Latin.

Al-Razi (Rhazes) (865-925) in his work "K al-Masuri," later printed in Latin as "Liber de medicina ad Almansorem" or "Liber Almansoris," discussed 26 chapters on anatomy. He made significant contributions to neuroanatomy by describing cranial and spinal nerves. Ibn Sina (Avicenna) (980-1037) in his book "Al Canun fi al Tibb," known in Europe as the "Canon," became one of the most influential medical texts up to the 18th century. In his work, he systemized anatomy and included a chapter with a detailed description of functional neuroanatomy (18).

The decline of Rome, the prevalence of diseases, and the upheaval of socioeconomic conditions resulted in a widespread lack of interest in the study of medicine and anatomy. In the early Middle Ages, the field of medicine came under the influence of the Christian church and Arab scholars. During this period, religious philosophy took precedence over scientific knowledge and study (19).

Middle Ages

The period known as the Renaissance was marked by a profound resurgence of science, spanning roughly from the fourteenth through the sixteenth centuries. It represented a transitional phase, bridging the gap between the Middle Ages and the dawn of the modern age of science.

With the fall of the Roman Empire, the authority of the Pope diminished, and religion became more unified. The "discovery" of America by Christopher Columbus in 1492 and the invention of the printing press with movable type by Gutenberg in 1454 were significant achievements that ignited a renewed interest in various fields of human endeavor.

The revival of interest in human anatomy was closely tied to the emergence of universities, but it required approval from both the church and the government. In Italy alone, between 1200 and 1350, 15 universities were established. The University of Salerno is recognized as one of Europe's earliest known universities, but it was the University of Bologna where human dissections were conducted. Initially, dissections were not for teaching anatomy but rather to ascertain the cause of death in suspected poisoning cases (Lassek, 1958). The medical faculty at the University of Bologna was established in 1156, and by 1320, it had attracted at least 15,000 students. Taddeo Alderotti was one of the first anatomists to teach at Bologna, conducting human dissections for anatomy teaching, as recorded by his disciples Bartolomeo da Varignana, Henri de Mondeville, and Mondino de Liuzzi (9, 20).

The Renaissance, with its revival of classicism, brought medical science, anatomy, and medical teaching back into prominence in Europe. Mondino de Luzzi (ca. 1270–1326) (Fig. 3) founded the first European medical school in Italy in 1235, incorporating the systematic study of anatomy and dissection into the medical curriculum (16).

Figure 3. Mondino de Liuzzi, the Italian anatomist, making his first dissection in the anatomy theatre at Bologna, 1318 – Painting by Ernest Boar (1877-1934)
(Republished from https://welcomecollection.org under CC BY license)

Anatomical representations during this period often took the form of hand-drawn sketches on paper and woodcut engravings. Mondino earned the esteemed title of the "Restorer of Anatomy" not solely for conducting one of the first human dissections in centuries, but more so for his innovative teaching methods and meticulous documentation of dissections. This remarkable feat resulted in the creation of one of the earliest modern anatomy textbooks and paved the way for the integration of the systematic study of anatomy into medical curricula.

The Renaissance men

The Renaissance, characterized by its revival of classical ideals, played a pivotal role in rekindling interest in medical science, anatomy, and medical education across Europe. A prominent figure during this period was Mondino de Luzzi (ca. 1270–1326), as we mentioned above he established the first European medical school in Italy in 1235 and a introduced anatomy and dissection into the curriculum (20).

Anatomical representations of that time were often captured through hand-drawn sketches on paper and woodcut engravings. As the 15th century unfolded, artists embraced an active role in advancing scientific knowledge and depicting the intricacies of the human body, exemplified by the remarkable anatomical paintings created by the legendary Leonardo da Vinci (1452–1519).

In the midst of the Renaissance, a pivotal shift in perception occurred as the human body evolved from a fragile dwelling of the soul to a symbol of beauty and fascination. During this epoch, the human form became a muse, inspiring artists to explore its intricacies with an unyielding passion. Notable figures like Leonardo da Vinci and Michelangelo were not content to merely observe dissections performed by their medically trained peers; they took matters into their own hands, wielding the scalpel themselves in their quest to depict the body's natural splendor.

For Leonardo da Vinci, the human body was more than a canvas; it was an object of profound interest and inquiry. Driven by an insatiable curiosity, he embarked on daring nocturnal missions, scaling cemetery walls under the cover of darkness to procure bodies for dissection. In the sanctity of his studio, he meticulously explored the human form, seeking a deeper understanding of its anatomy.

Leonardo's bold approach to dissection allowed him to achieve unparalleled realism in his art. His sculptures and paintings not only captured the muscles of the human body in exquisite detail but also portrayed the delicate interplay between bone structure, skeleton, and skin (21, 22).

In his quest for knowledge, Leonardo produced a wealth of anatomical drawings that showcased the human body from multiple perspectives. His passion for detail extended beyond illustration; he accompanied his drawings with thoughtful inquiries and remarks, delving into the functions that underpinned the form. While Leonardo's anatomical studies were not immune to errors and misconceptions, they remain an indelible testament to his pioneering spirit. He accurately described the curvature of the spinal column and the true position of the fetus in utero (Fig. 4), making significant contributions to the understanding of human anatomy (23).

Figure 4. The image displays a cross-section of the pregnant uterus, revealing the fetus in its natural orientation (Republished from Wikimedia Commons www.en.wikipedia.org/wiki.File: Leonardo_da_Vinci_Studies_of_the Foetus _in_Womb.jpg under CC BY license)

Leonardo's unwavering dedication to the scientific pursuit of anatomy was far ahead of his time. Armed with simple tools and methods, his quest for knowledge laid the groundwork for the modernization of anatomical studies, a legacy that would only come to fruition centuries later with technological advancements like magnetic resonance imaging (MRI).

In the grand tapestry of the Renaissance, Leonardo da Vinci emerges as a "philosopher-anatomist," transcending the boundaries of art and anatomy. His work continues to inspire and captivate generations of scholars and artists, solidifying his position as a true Renaissance master (24).

In the midst of the Renaissance, the artistic style of realism flourished, captivating the minds of artists. At the heart of this transformation stood Andreas Vesalius (1514–1564), a Flemish anatomist whose groundbreaking work in anatomy earned him the title of the "father of modern human anatomy"(25).

During the medieval period, medical practices often relied on erroneous beliefs and superstitions. Treatments like bloodletting, applying dung to wounds, or even drilling holes into the skull were based on the notion of balancing the four humors and consulting astrology before deciding on a course of action. The understanding of the human body was shrouded in mysticism.

Vesalius, however, challenged these misconceptions. Through his meticulous dissections, Vesalius made groundbreaking discoveries that had previously gone unnoticed. His book "De humani corporis fabrica libri septem" ("The Seven Books on the Structure of the Human Body") featured detailed and accurate illustrations of his anatomical discoveries (26) (Fig. 5). Vesalius's boldness extended to conducting the first public dissection on a human corpse, challenging societal norms and contributing to the progress of medical knowledge. He revealed the presence of valves within veins, shedding light on the circulatory system's mechanics, and recognized the heart as the central pump responsible for circulating blood throughout the body, correcting the belief that the jaw was comprised of two bones, revealing its true anatomical structure (27).

These groundbreaking revelations encouraged other physicians to question and challenge the prevailing ancient medical beliefs. Vesalius's willingness to explore the human body through dissection led him to uncover the intricate details that had long eluded his predecessors.

If not for the revolutionary practices of Vesalius, who knows, perhaps the misconceptions of medieval anatomy would have survived to this day (28, 29).

Figure 5. Title page of Vesalius's De Humani Corporis Fabrica, 1543

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Harvey and Leeuwenhoek's scientific breakthroughs

In the seventeenth and eighteenth centuries, anatomy gained considerable recognition and acquired a certain touch of theatricality. Across Europe, elaborate amphitheaters hosted public demonstrations of human dissections, attracting wealthy audiences with exorbitantly priced tickets. Amidst this spectacle, serious and scientific-minded anatomists also made significant contributions that transformed the study of human anatomy (30).

One such pioneering figure was William Harvey (1578–1657), an English physician whose groundbreaking work, "On the Motion of the Heart and Blood in Animals," published in 1628, revolutionized medical understanding (31). In a classic example of the scientific method, Harvey provided irrefutable evidence for the continuous circulation of blood within the vessels, challenging the prevailing Galenic philosophy (Fig. 6). Despite severe criticism, Harvey's discoveries ultimately prevailed, sparking a new era of experimental medicine and empirical investigation (32, 33).

Another luminary of this period was Antoni van Leeuwenhoek (1632–1723), a Dutch optician and lens grinder. With his mastery of microscopes, Leeuwenhoek achieved a magnification of 270 times, enabling him to examine tissues and describe blood cells, skeletal muscles, and the eye's lens. His detailed observations, including the accurate description of sperm cells, advanced the understanding of human anatomy.

Figure 6. Harvey showcases the interconnection of valves and arteries in the arm using a ligature, highlighting the role of vein valves in enabling blood flow back to the heart
(Republished from reference 36 - https://circulatingnow.nlm.nih.gov/2018/02/06/an-anatomical-essay-on-the-movement-of-the-heart/ under CC BY license)

The advent of improved microscopes brought a transformative dimension to anatomy, unraveling the mysteries of basic body functions and shedding light on disease etiologies. Although the credit for the microscope's invention is often attributed to Zacharius Janssen, Leeuwenhoek's mastery of it propelled anatomical exploration to new heights (35).
In this period of reawakening and scientific breakthroughs, Harvey and Leeuwenhoek's contributions remain beacons of progress, illuminating the path toward a deeper understanding of the human body and heralding the dawn of modern scientific medicine (36).
Malpighi was the first person to make important scientific observations using then what was described as a microscope. Revered as the father of microanatomy, his meticulous explorations unveiled a plethora of intricate structures previously unseen. Among his remarkable discoveries, Malpighi identified and described the glomeruli in the kidneys, chronicling these findings in his groundbreaking work, "De Viscerum Structura Exercitatio Anatomica," published in 1659. In the same revolutionary year, he offered unparalleled precision in describing the spleen and the corpuscles within it, which would come to bear his name as a testament to his enduring legacy (37).
The earliest major changes in the study of the nervous system began with the clinical work of the brilliant physician Thomas Willis (1625-1675). He was one of the first to provide a fairly accurate description of the anatomy of the brain, spinal cord, peripheral nervous system, and autonomic nervous system. Willis described the arteries at the base of the brain as forming an arterial circle, now known as the circle of Willis's circle (Fig. 7).
He should be considered a pioneer in neuropathology, as he was one of the first to correlate clinical findings in a patient with changes found in the brain at autopsy (38). Many other individuals' anatomy described during this 200-year period.
As the eighteenth century dawned, human anatomy had made significant strides, with most of the body already mapped out, except for the intricate minute structures. However, the advent of improved microscopes opened up new horizons, allowing anatomists to delve deeper into the complexities of living tissues.
This progress was facilitated by the publication of impressive textbooks and exquisite atlases, decorated with elaborate engraved plates, authored by renowned anatomists of the era. The synergy of advanced instruments and scientific publications brought the study of anatomy to unprecedented heights during this period (39).

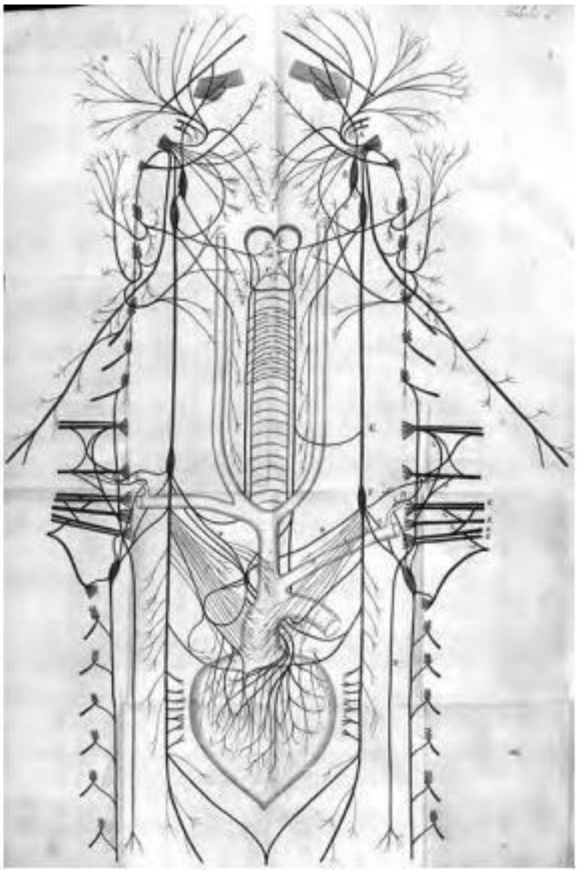

Figure 7. An illustration portraying cardiac innervation from Thomas Willis' work "Cerebri Anatomy"
(Republished from Anatomia Animata. The Head. http://www.indiana.edu/~liblilly/anatomia/ head.html under CC-BY license)

The pioneering surgeon-anatomists made invaluable contributions to the advancement of medicine and surgery, thanks to their profound understanding of the human body's intricate structure. Through their insights, they unraveled the nature of these structures, sparking new avenues for research and exploration. However, it's essential to acknowledge that the acquisition of bodies for dissection was often illegal during their time, yet it was essential for their groundbreaking work to be possible. Despite the ethical dilemmas, their dedication to scientific progress significantly shaped the course of medical history (40).

In the spring of 1829, a bill was presented in the House of Commons with the aim of regulating the provision of deceased bodies for dissection in anatomy schools. At that time it was not accepted but served as a prototype for other countries. The Anatomy Act brought to an end the illegal trade with corpses because it made provision for an adequate supply of bodies for the proper teaching of anatomy (41).

Anatomy in the era of modern multimedia

Over the past two decades, the landscape of anatomical research has been reshaped by remarkable technological innovations. These innovations have not only transformed the way we visualize and understand the human body but have also paved the way for groundbreaking advancements in medical practice.

The discovery of X-ray machines in 1895 finally allowed physicians to visualize the inside of a human body without dissection. In 1930, Felix Bloch, along with Edward Purcell, made pioneering contributions to the development of MRI, a technique that would revolutionize medical imaging. Their work, for which they later shared the 1952 Nobel Prize in Physics, laid the foundation for MRI. MRI employs powerful magnets that generate a strong magnetic field, causing protons within the body to align with this field. When a radiofrequency current is then pulsed through the patient, the protons are stimulated, deviating from their equilibrium state, and resisting the magnetic field's pull. Upon discontinuation of the radiofrequency field, sensitive MRI sensors detect the energy emitted as the protons realign with the magnetic field. This realignment process, as well as the energy release, varies depending on the

Physicians can differentiate various types of tissues based on these magnetic properties.
Godfrey Hounsfield and Allan Cormack worked extensively on the development of computed tomography (CT) prototypes over several years before their groundbreaking achievements were widely recognized in 1972. Their work paved the way for the use of CT scanners to study organs in unprecedented detail (Fig. 8).

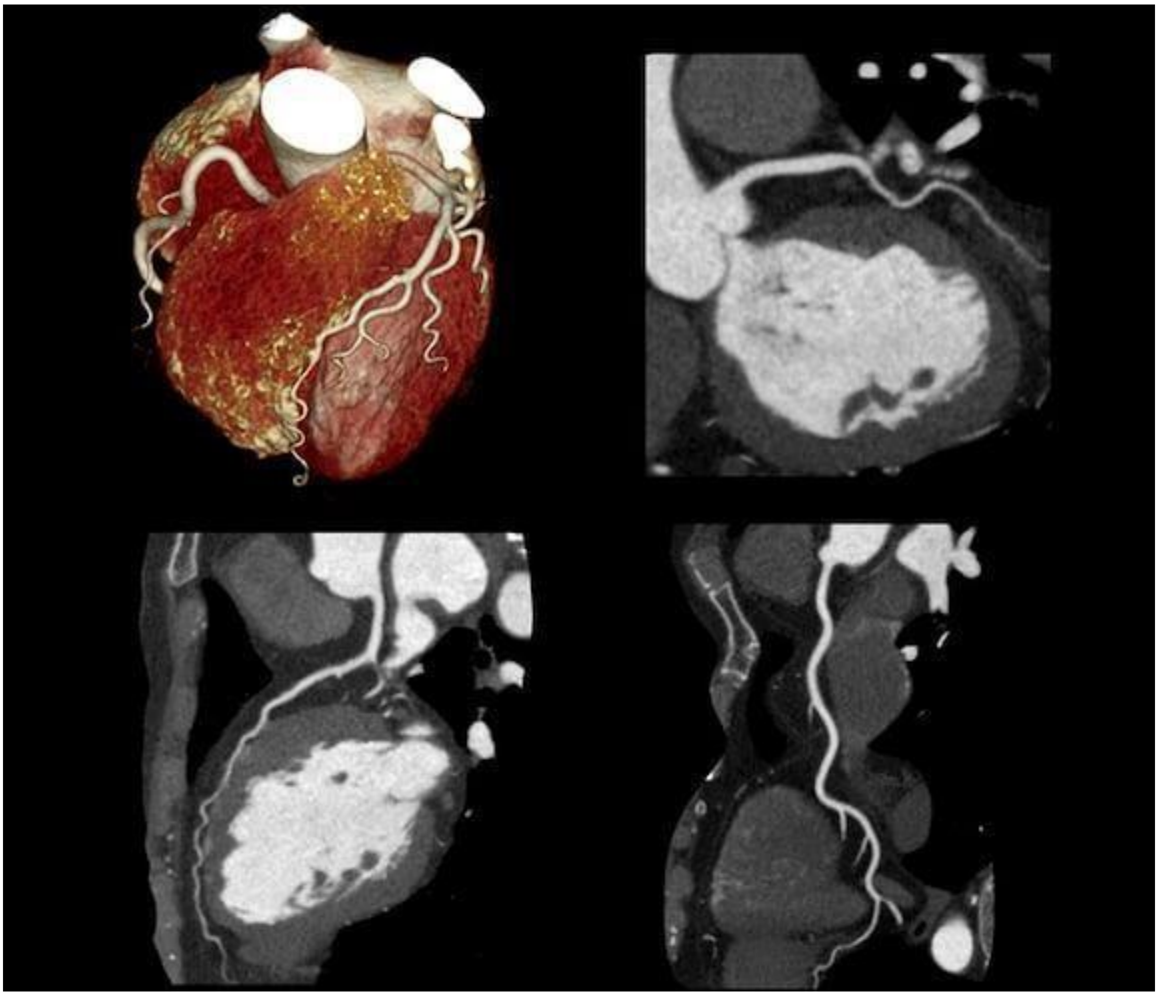

Figure 8. Cardiac coronary computed tomography angiography (CCTA)
(Republished from https://www.itnonline.com/article/trends-cardiac-imaging-over-past-decade-show-rapid-rise-ct under CC BY license)

As a remarkable testament to the versatility of medical imaging, CT scanning has even found applications in the realm of archaeology and anthropology. Researchers have employed CT scans to study mummies from various regions and time periods, providing valuable insights into the health and lifestyles of ancient civilizations.
One particularly intriguing discovery is the evidence of atherosclerosis, a condition characterized by the hardening and narrowing of arteries, found in the mummified remains of humans from around the world. These CT findings of atherosclerosis in mummies bear a striking resemblance to those observed in modern patients. This remarkable revelation underscores the presence of cardiovascular disease in ancient populations and raises questions about the factors contributing to its prevalence throughout history.
Such investigations not only bridge the gap between past and present but also demonstrate the enduring value of advanced medical imaging techniques in uncovering the secrets of human history.
The adage "big surgeon, big incision" was fading into oblivion, making way for the era of minimally invasive procedures. The small incisions of multiple portal laparoscopic surgeries heralded a new dawn, a prelude to the potential of single incision laparoscopic surgery (SILS) and the futuristic promise of natural orifice transluminal endoscopic surgery (NOTES). These innovations sought to not only advance medical

practice but to rewrite the narrative of surgical scars, leaving behind minimal to no trace.

In the pursuit of excellence, one truth remains—perfect knowledge of anatomy is the bedrock upon which medical innovation is built. It is important to remember that this rich legacy has been acquired through the age-old traditions of dissection (43).

Challenges arising from modern visualization advances

The shift towards virtual reality and advanced technologies has ignited debates about the continued relevance of cadaveric dissection. The autopsy rate steadily declined in the second half of the last century to fall below 10% in the USA. The decline in hospital autopsy rates can be attributed to various factors, including the removal of minimum autopsy rate requirements for healthcare accreditation and a lack of clinician awareness about the benefits of autopsies. The unwillingness of treating clinicians to attend the autopsy or in some instances even discuss the case gives rise to further misconceptions about the clinical value of autopsies (44).

While it's often suggested that advancements in fundamental medical science and imaging have reduced the need for autopsies, the importance of this practice remains undiminished. Autopsies continue to play a crucial role in various areas, including education, quality assurance, and the precise determination of the cause of death.

Historically, autopsies have significantly contributed to our understanding of cardiovascular anatomy, physiology, and pathology. They have been instrumental in the field of interventional and surgical therapy. By studying the anatomical changes observed during autopsy, both in patients who underwent surgery and those who did not, surgeons were guided by them in developing and improving corrective and palliative approaches and continue to do so today.

Nowadays, autopsies can still be extremely helpful in elucidating potential acute and chronic complications related to cardiac interventions/surgery, particularly when using novel devices or new technologies. Because of the large number of devices implanted annually in the cardiac surgery and interventional cardiology arena (Fig. 9), any examination including autopsy that reveals adverse circumstances and unexpected side effects in the short- and long-term has the potential to have a high impact and supports the need for pathological assessment.

Figure 9. Cardiovascular interventional radiology

In the era of transcatheter aortic valve implantation (TAVI), a multi-center autopsy series of patients dying after the procedure showed that in the acute post-implantation time frame, the procedure could be associated with aortic annular rupture and thromboembolic ischemic stroke. In particular, bulky calcification in the left ventricular outflow tract under the left-coronary aortic cusp could be a risk factor for rupture during TAVI (46). Autopsies have also helped to demonstrate that the depth of prosthesis implantation is one of the most important predictors of the need for pacemaker implantation due to conduction disorders soon after transcatheter self-expandable aortic valve implantation (47).

For electrophysiologists, interventional cardiologists, cardiovascular surgeons, mastery of complex vascular pathways, delicate suture choreography, and the art of transplantation all rely on a deep knowledge of anatomy. With its chambers and blood vessels, the heart holds secrets that can only be revealed through careful examination. Can virtual simulations replicate the tactile intricacies of human tissues and organs or the nuances of surgical instrument interaction (48)?

Conclusion

The field of cardiovascular medicine is a vivid illustration of the symbiotic relationship between tradition and innovation. Autopsies, with their timeless significance, constantly guide doctors and researchers to improve interventions and surgical techniques. The intricate details revealed during autopsies have paved the way for remarkable achievements, from elucidating the pathogenesis of diseases to improving surgical procedures.

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