

Human anatomy in the Renaissance. Historical context and medical and anatomical importance of the *De Humani Corporis Fabrica libri septem* by Andres Vesalius

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Abstract

During the second half of the 14th century, scholars in Europe began distancing themselves from the philosophy of Aristotle, which had been, one way or another, the main influence on western culture all through the Middle Ages. This new tendency also gained traction in scientific fields, specifically medicine, and solidified between the 15th and 16th century. It is in this context that Mondino de' Liuzzi's anatomical studies and teaching find their place.

The first illustrated work to represent the new scientific approach is the *fasciculus Medicinae*, published by Johannes de Ketham.

Doctors and anatomists of the late 15th and early 16th century carried out a critical analysis of the work of Galenus, the most influential scholar in the field of medicine until then.

Charles Estienne and Johannes Dryander are two of the foremost representatives of this novel approach. Estienne's collaboration with surgeon and dissector Estienne de la Rivière produced the *De dissectione partium corporis humani*; coming from a family of printers, Estienne was able to take care of the layout format, paying particular attention to the numerous and anatomically accurate illustrations. With his richly illustrated *Anatomia Capitiis Humani*, Dryander created neuroanatomy. The most prominent figure in the field is however Vesalius. Vesalius learned the fundamentals of medicine in Lovain but he also studied Greek and Latin very thoroughly. He completed his medical studies in Paris, where he performed his first dissections; there, his knowledge of the works of Galenus grew deeper and more solid, as he helped Guinter in their translation.

In 1537 he moved to Padua, where he earned his doctorate; he also published the *Tabulae Anatomicae sex*: according to a cartouche, the work was illustrated by Jan Stephan van Calcar. Although Vasari states that the creation of all the main drawings of the *De Humani Corporis Fabrica* was supervised by van Calcar, no certain proof of that is available.

In the *De Humani*, which consists of seven books, Vesalio registers at least 300 inaccuracies in the works of Galenus.

The numerous sketches found in the work show an extremely high level of anatomical accuracy and morphological precision; the proportions, especially in the main drawings, are impeccable and it is possible that Vesalius had studied the Canon of Polycletus, as Galenus makes exact references to it in his works. The excellent editing is due to Johannes Herbster, known as Oporinus of Basil.

The second drawing of the first book (osteoarthrology) is a perfect example of the anatomical accuracy and skilled editing that make this work so remarkable and effectively sums up the vision Vesalius and his collaborators had when creating the *De Humani Corporis Fabrica*.

Introduction: historical context

In the 14th century, European intellectuals begin distancing themselves from the rigor of rationalistic and scholastic philosophy; although the traditional medieval education in the disciplines of the trivium and quadrivium is not completely rejected, many show increasing interest in the observation of natural phenomena and question the philosophy of Aristotle as the cultural benchmark (1). In the medical field, scholars feel that it is necessary to verify the work of Galenus. The idea of teaching anatomy and surgery by performing actual dissection on corpses was first introduced by Mondino de' Liuzzi; he did not, however, perform them personally: he would instead read the ancient texts to his students (although he himself was the author of an "*Anothomia*") and leave the dissection to a surgeon (2;3;4). However, these innovative ideas are only fully developed in the 15th century and extensively put into practice in the following centuries.

The printing press provided a crucial contribution to the spreading of knowledge, especially as far as medicine and anatomy were concerned: not only were scientific text now based on anatomical data retrieved through a direct study of corpses - which also allowed for a higher accuracy in the illustrations -, it was also possible to reproduce these works indefinitely, thus making medical and anatomical knowledge more accessible. One of the earliest examples of this is the *Fasciculus de Medicina*, a work made up of six "books" (or, to be more precise, chapters or topics): uroscopy, astrology, bloodletting, the treatment of wounds, plague, anatomical dissection and women's health; Johannes de Ketham probably put together the various chapters and had them printed as a whole in 1491 (5).

Mondino de' Liuzzi's work was only published in 1514 thanks to Berengarius of Carpi, himself the author of a work titled *Isagoogae breves* (1523) (6;7).

Another prominent figure from the time was Alessandro Achillini, master of *Natural Philosophy and Theoretical Medicine*. Achillini wrote a text titled *Anatomicae annotationes*, published in print after his death (1512) in 1520; despite being the result of accurate studies, the work is not complete with adequate illustrations (8).

In the first few decades of the 1500 many physicians studied anatomy by performing anatomical dissections of human corpses personally: the written works that followed often contained illustrations for educational purposes.

Charles Estienne was born in 1504 in a family of accomplished printers, based in rue Saint-Jean de Beauvais, Paris, and was therefore a contemporary of Vesalius, born in 1514; after receiving a humanistic education, he studied medicine in Paris, where he earned his doctorate: his mentors were Jacques Dubois (or Silvius) and Johan Gunter von Andermach; he then completed his training in Padua (9).

His work resulted from the anatomical dissections he performed with the collaboration of Etienne de la Riviere, an experienced surgeon; the illustrations were created by engraver Jean "Mercure" Jollat (10). Because of a legal dispute with de la Riviere, the release of the *De dissectione partium corporis humani* was repeatedly postponed and the work only saw the light in 1545. In 1564, Estienne died in Paris.

Estienne's work is a remarkable treaty of anatomy, complete with at least 28 sketches, all morphologically accurate but, despite Estienne's intentions, aesthetically imperfect; the author also insisted that the backgrounds received particular attention. Among other things, Estienne described the valves of hepatic veins, studied the basis of the brain and, most importantly, proved the existence of the cerebrospinal fluid in the spinal cord (9;10).

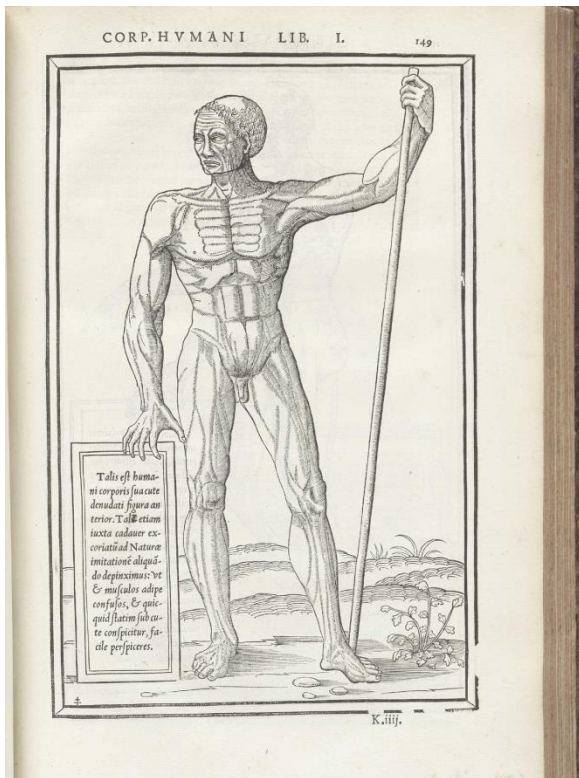


Fig.1." Decorticato" of Charles Estienn with image of Jollat taken from *de Dissectione partium corporis humani*

As regards the CNS, one cannot forget to mention Johannes Dryander, a German physician born in Marburg in 1500 and deceased in 1560; he studied in Paris and produced several works, among which we find the *Anatomia Capitis Humani*, published in 1536, where he describes the anatomy of the skull and brain: the work, complete with numerous drawings, marks the birth of neuroanatomy (11).

Many other anatomists from this time are worthy of mention. Realdo Colombo, for instance, who had replaced Vesalius when he left the University of Padua in 1543, published a seminal work in 1573, titled *De re anatomica*, where he describes the clitoris and introduces the idea of a "small circulation" connecting heart and lungs: the theory was later developed by William Harvey in his *De motu cordis e sanguinis* (1628), where he describes the modern model of blood circulation. Colombo's work, however, has no illustrations (12).

This is the cultural and scientific background of Andrea van Vessel's work.

Biography

Andres Vesalius was born in Brussels on the 31st December 1514 from a prestigious family of doctors and apothecaries working for the Augsburg court. His great-grandfather was a medical doctor and a professor in Leuven, his grandfather was the Emperor's physician and his father an apothecary at the Augsburg court (13).

Andre received a first-rate education since childhood: in Leuven, he attended the "trilingual school", where he learned Latin, Greek and Hebrew and the liberal arts. He then moved to Paris to study medicine. There, his masters were Johan Gunther von Andernach e Jacques Dubois (Silvio) (13). Gunther was a remarkable physician and scholar and although he never practiced anatomical dissection, he translated the main works of Galenus and Paolo of Egina from Greek with help from

Vesalius, himself a connoisseur of the Greek language.

In Paris, Vesalius completed his studies carrying out anatomical studies directly on cadavers or human body parts recovered from the Cimetier des Innocents or on the corpses of executed criminals (as reported in the Preface of the *De Humani*).

In 1537, Vesalius moved to Padua, where he earns his doctorate in medicine and is appointed to the chair of anatomy ((13). Around this time, he starts writing and publishing anatomical works, beginning with the *Tabulae Anatomicae sex* in 1538, followed by the *De Humani Corporis Fabrica libri septem*, published in Basel by Oporinus in 1543, soon accompanied by the so-called Epitome, an illustrated summary of the work. A second edition of the *De Humani* was published in 1555 with some small changes (14).

It was mentioned before that Vesalius had gained extensive knowledge of the work of Galenus. Vesalius' approach to his work epitomises that of many other 16th century anatomists, who attempted to verify the content of those works by performing dissections personally, as opposed to reading and commenting the text and leaving the dissection to a surgeon. Direct dissections allowed Vesalius to identify at least 300 inaccuracies in Galenus' descriptions, which, as a matter of fact, were based on animal dissections, especially primates (14). Among other things, Vesalius highlights that the septums dividing heart cavities are not in fact porous (a mere hypothesis in the 1543 edition, confirmed in 1555), disproved the existence of the rete mirabilis in humans (a network of blood vessels at the base of the brain) and demonstrated that nerves are not hollow ducts but compact structures.

It must be specified that dissections on human cadavers were only possible in the colder seasons and depended on the number of executed criminals. Therefore, anatomists still relied on animal dissections as an alternative. This detail is specified by Vesalius himself when describing dissection tools, pictured in an accurate sketch of the *De Humani*.

De Humani Corporis Fabrica libri septem

The *De Humani* consists of seven books, each containing accurate anatomical descriptions and enriched by at least 22 full-figure sketches and several other smaller pictures describing human anatomy eidologically. Paragraphs begin with richly decorated initial capitals depicting multiple small human figures (15).

The First Book describes osteoarthrology and includes three full-figure drawings.

The Second Book describes myology and contains fourteen formally impeccable and extremely detailed full-figure drawings.

The Third Book, with four full figures, describes the vascular network.

The Fourth Book describes the spinal cord and the nerves stemming from it and contains one full-figure drawing.

The Fifth Book describes abdominal viscera and contains wonderful half-page sketches, as well as the Sixth Book, concerning the thorax (heart and lungs).

The Seventh Book is dedicated to the brain and accurately describes cerebral cavities and the meninges lining it. Anatomical drawings are as always accurate and formally impeccable (15).

One of the most remarkable features of both major and half-page sketches are the perfect proportions, which make us think that Vesalius knew the principles of Polykelitos' Canon on body proportions. Polykleitos was a Greek sculptor from the 5th century BC who, in his "Canon", codified the criteria to create perfectly proportionate statues of great aesthetical impact. Although his treaty is lost to history (as well as his original works) (16), it was often quoted by later authors, especially Galenus, who reports most of its content. It is therefore reasonable to conclude that Vesalius came to know of the Canon through the work of Galenus. The contents of the Canon were



Fig.3a First Table of Muscles



3b Second Table of Muscles

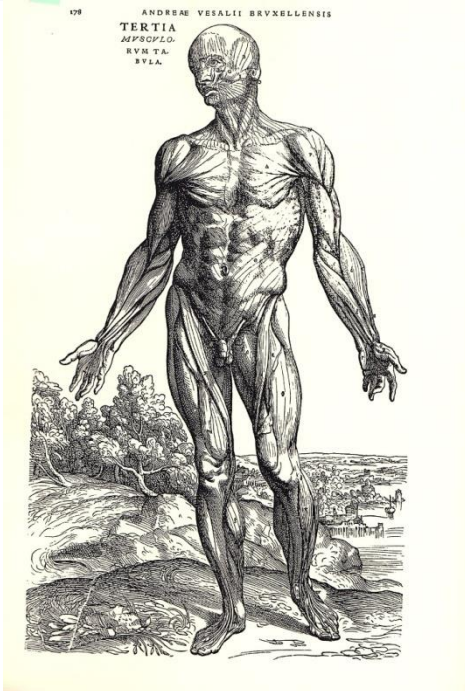
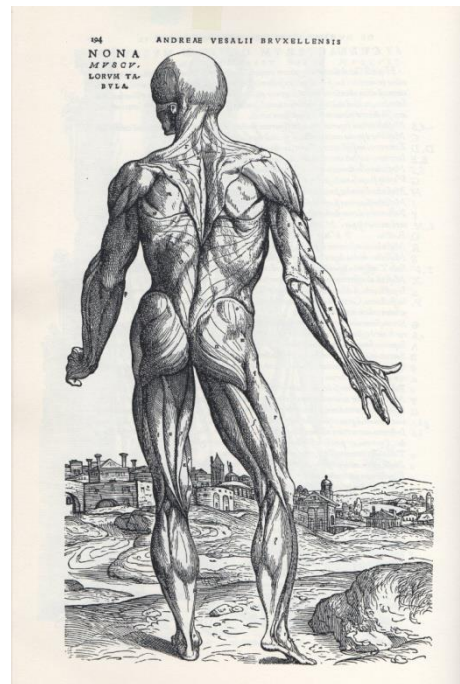


Fig. 3c Third Table of Muscles



3d Ninth Table of Muscles

Drawings fourth to eight and ten to fourteen are very detailed and allow the reader to visualise the space occupied by the muscle; tendons are also very precisely depicted (fig.4).

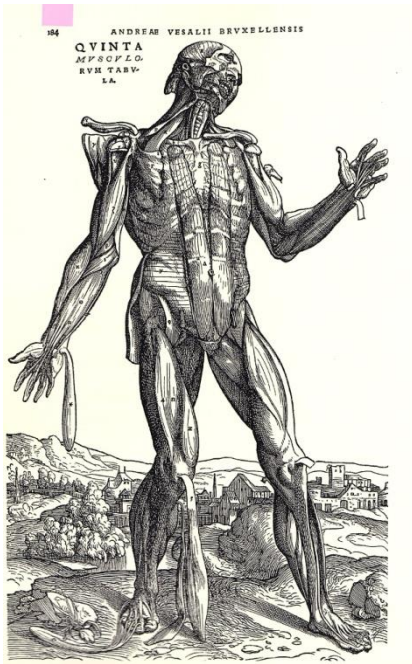


Fig. 4 Fifth table of muscles with excellent clarification of the lodges, locations of the muscles

Some figures are portrayed in specific poses (e.g. suspended, leaning on a wall) in order to highlight certain anatomical details, such as intercostals muscles or the connection between leg muscles and knee joints. Eleven illustrations also have a typically remarkable background.

One cannot fail to also mention the two full-figure drawings describing the vascular network and the nervous system.

The drawings required great expertise. All the main illustrations in the *De Humani Corporis Fabrica* are usually attributed to Jan Stephan van Calcar. He was born in Kalkar between 1499 and 1510 and learned the fundamentals of the painting technique by Jan van Scorel; he later moved to Italy, probably as an attempt to help a girl get away from a violent family, spent some time in Rome and then arrived in Venice in order to complete his artistic education in the bottega of Tiziano. It is certain that in 1537 he collaborated with Vesalio for the *Tabulae Anatomicae sex*; this is confirmed by the cartouche in the first drawing of the book (17).

His role in the *De Humani Corporis Fabrica* is less clear. Vasari is certain that he worked on the full-body drawings but this is not confirmed by any other source. The quality of the illustrations definitely points to that, as van Calcar is known to be a remarkable artist. It is also impossible to prove that van Calcar knew the canon of Polykleitos; however, it is also impossible to prove the contrary, as he may have learned it from Vesalius himself. Van Calcar died in Naples in 1545 (17).

It is also necessary to mention the printer of the *De Humani Corporis Fabrica*: Johannes Herbster, also known as Oporinus of Basel. There were many important printers in Venice at the time, but Vesalius chose a typographer from Basel. A possible explanation is that Oporinus had studied medicine and collaborated with Paracelsus and could therefore ensure the most appropriate and satisfying typographic result (18).

Conclusions

I believe it appropriate to conclude this excursus of the *De Humani Corporis Fabrica* with the second osteology drawing: a skeleton, seen from the side, with its lower left limb flexing and resting on the right; the left elbow sustains the weight of the head, resting on the hand, thanks to a balustrade, onto which rests also the right arm, extended forwards to touch a cranium. The inscription on the front of the

balaustrade is a quote from the *"Elegies for Maecenas"* (an anonymous work dating back to the early centuries AD) that some attribute to Virgil. The quote definitely suggests the author's great erudition, but it also carries an important message. It puts into words the spirit that animated the production of the *De Humani*, scientifically, aesthetically and editorially speaking. It is also probably an acknowledgement by Vesalius to all the people that contributed to the production of his masterpiece, those who helped him with dissections, who perfected the anatomical details of the illustrations, who decorated the initial capitals of the paragraphs. We live through the works of ingenuity, they survive through the centuries, and all else is destined to perish.

Vivitur Ingenio, Caetera Mortis Erunt.

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