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A Double Edged Blade: Contrasting Theories of Dissection within 16th Century Italy

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The history of dissection is as varied as it is gruesome. There is a certain macabre fascination to opening up a corpse and seeing one's own mortality within. The practice of dissection began in ancient Alexandria, and while it dropped off shortly after, the practice experienced a revival in 13th and 14th century Europe. This resurgence, which coincided with the beginning of the Renaissance, was centered in the liberal arts universities of Italy; the University of Padua in particular played host to several notable anatomists. This new iteration of dissection was rigidly structured, and relied heavily on the work of past medical authorities to guide it. A transformation in the very nature of the anatomical dissection, from a vehicle for conveying dogmatic and inaccurate beliefs to a tool for research and exploration, occurred throughout Italy during the second half of the 16th century following the publishing of Vesalius's revolutionary anatomical textbook, *De Humani Corporis Fabrica Libri Septem*. This shift was cemented into medical culture in 1594 with the construction of the oldest permanent anatomical theatre in Padua, Italy.

The very first dissection is widely credited to Herophilus of Chalcedon and his contemporary Erasistratus of Ceos,[1] who in 3rd century BC Alexandria, dissected and vivisected the bodies of executed criminals supplied by one of the Ptolemaic pharaohs.[2] They would be the only physicians to perform a human anatomical dissection or vivisection for roughly 1500 years.[3] Professor Heinrich Von Staden of the Institute for Advanced Studies suggests several cultural and moral taboos prevented an earlier iteration, or later continuation of the practice, such as a belief in the inherent pollution of a corpse that led to strict sacred laws surrounding the burial of

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[1] Sanjib Kumar Ghosh,"Human Cadaveric Dissection: a historical account from Ancient Greece to the Modern era," *Anatomy, Cell, Biology* 48, no. 3 (2015): 154, doi: 10.5115/acb.2015.48.3.153.
[2] Noel Si-Yang Bay and Boon-Huat Bay, "Greek anatomist herophilus: the father of anatomy," *Anat Cell Biol.* 43, no. 4 (2010): 281, doi: 10.5115/acb.2010.43.4.280.
[3] P. Prioreschi, "Determinants of the revival of the dissection of the human body during the Middle Ages," *Medical Hypotheses* 56, no. 2 (2001): 229, doi: 0.1054/mehy.2000.1183.

the dead, and a strong dislike for violating the protective barrier of the skin.[4] Despite the discontinuation of anatomical dissections following the deaths of Herophilus and Erasistratus, their discoveries, such as the distinction between the cerebrum and cerebellum, would be preserved and referred to by succeeding physicians.

The work of one such physician, Galen (129 CE-216 CE), would come to dominate medical thinking in Medieval Europe. He too was a strong proponent of anatomical dissection, but believed animal corpses would suffice for evidence. In many cases, they did, with Galen being the first to propose that the arteries carried blood rather than air, and describe the valves of the heart.[5] However, the Galenic liver, drawing from the work of Hippocrates (460 BC-370 BC)[6] and his own dissections of dogs, has five lobes, while the human liver has four.[7] Galen was also a proponent of the humoral theory of medicine, drawing once again from Hippocrates, which ascribed sickness to an imbalance of the bodily humors; phlegm, blood, black bile, and yellow bile. Galen added that the humoral imbalances could be pinpointed to a specific organ in the body, allowing for specific diagnoses and treatments such as bloodletting, which would continue to be viewed as a viable medical treatment until as late as the 17th century.[8] This helps to illustrate the far reaching effect of Galen's work, and the somewhat flawed anatomical premises that later physicians would build their work on.

A key factor in why Galen's work would become so widespread in Europe is the preservation and documentation of his writings by Muslim scholars. Ibn Sina or Avicenna (980

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[4] Heinrich Von Staden, "The discovery of the body: human dissection and its cultural contexts in ancient Greece," *Yale J Biol Med* 65, no. 3 (1992): 225-228, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2589595/?page=8.
[5] V. Nutton, "Galen," *Encyclopedia Britannica*, September 27, 2022, https://www.britannica.com/biography/Galen.
[6] W.D. Smith, "Hippocrates," *Encyclopedia Britannica*, November 15, 2022, https://www.britannica.com/biography/Hippocrates.
[7] Nils O. Sjöstrand, "Den medicinska illustrationen som uttryck för föreställning och villa--levern som historiskt exempel" [The medical illustration as the expression of illusion and imagination--the liver as an exampel from history], *vensk medicinhistorisk tidskrift* 11, no. 1 (2007): 17-51, https://pubmed.ncbi.nlm.nih.gov/18548944/.
[8] V. Nutton, "Galen," *Encyclopedia Britannica*, September 27, 2022, https://www.britannica.com/biography/Galen.

CE-1037 CE), regarded as one of the most important physicians of the Islamic Golden age, cites Galen over three hundred times in his *Canon of Medicine,* although he disagrees with him on several points.[9] For example, Galen asserts that pain is the result of a breach of continuity, or external injury, whereas Avicenna points towards a temperament change, or alteration of the physical condition.[10] Similarly, Abu Bakr al-Razi, or Rhazes (854-925) criticizes Galen in his monumental medical encyclopedia *al-Hawi*, on his descriptions of urinary ailments, citing more clinical experience than Galen.[11],[12] Rhazes simultaneously preserves and critiques Galen's writings in his *Kitab al-Mansuri,* which is eventually translated and edited by the widely regarded Belgian anatomist Andreas Vesalius (1514-1564) in 1537.[13] Avicenna's *Canon* makes its way into Europe by a similar path, being translated into Latin in the early 13th century by Gerard of Cremona, and serving as a medical textbook in Italian universities until as late as the 18th century.[14]

Another notable expansion upon Galen's work is the *Anothomia corporis humani* by Mondino de Liuzzi (1270-1326), often referred to as the 'restorer of anatomy'. Written in 1316, de Liuzzi was the first physician to both perform a dissection and document his findings, and had the practical experience that Galen lacked. As a result, his *Anathomia* differs from traditional Galenic theory.[15] Instead of blindly confirming Galen's work, de Liuzzi sought evidence to

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[9] Sajjad Sadeghi et al. "Galen's place in Avicenna's *The Canon of Medicine*: Respect, confirmation and criticism," *Journal of Integrative Medicine* 18, no. 1 (2020): 21-25, doi: 10.1016/j.joim.2019.11.002.
[10] Osama A. Tashani and Mark I Johnson, "Avicenna's concept of pain," *The Libyan journal of medicine* 5, no. 10 (2010): 1-4, doi:10.3402/ljm.v5i0.5253.
[11] Abdul Haq Compier, "Rhazes in the renaissance of Andreas Vesalius," *Medical history* 56, no. 1 (2012): 4 , doi:10.1017/S0025727300000259.
[12] Lutz Richter-Bernburg, "Hawi, Al," *Encyclopaedia Iranica,* Encyclopaedia Iranica, December 15, 2003. https://iranicaonline.org/articles/hawi-medical-book.
[13] Abdul Haq Compier, "Rhazes in the renaissance of Andreas Vesalius," *Medical history* 56, no. 1 (2012): 10, doi:10.1017/S0025727300000259.
[14] J. Janssens, *Ibn Sīnā (Avicenna), Latin Translations of.,* trans Heinrich Lagerlund, (Dordrecht: Springer, 2011; Encyclopedia of Medieval Philosophy, 20200, https://doi.org/10.1007/978-1-4020-9729-4_232.
[15] Berardo Di Matteo et al." Art in Science: Mondino de' Liuzzi: The Restorer of Anatomy," *Clinical orthopaedics and related research* 475 no. 7 (2017): 1794, doi:10.1007/s11999-016-5213-5.

verify it, which he did not always find.[16] For example, the Galenic heart is dual chambered, whereas de Liuzzi describes a three chambered heart, his description stemming from clinical observations. Despite the contradiction, he upholds Galen's idea that the vital spirits of the body form in the heart, although he describes the middle chamber rather than the left ventricle as the place of formation.[17],[18] While de Liuzzi contradicts Galen on several points, the heart being one of them, his work largely agrees with the key tenets of Galenic medicine. The *Anothomia* would come to be a key medical textbook, read and studied by every practicing physician across Europe. De Liuzzi's writings help disseminate and enshrine Galen's work in medical practice, although his disagreements with Galen left room for future physicians and anatomists to question their understanding of anatomy.

Up until 1231, the practice of dissection in Europe was nonexistent.[19] A papal bull by Pope Boniface VIII on September 27, 1299 referred to as both "De Sepulturis" and "Detestandae Feritatis" has been largely interpreted as a decree against anatomical dissection. A translation of it reads, "Loathing the abuse of savagery, […] we determined this abuse to be abolished, namely that [the aforementioned] not tear apart the corrupted human remains of another, so let it both move with horror the minds of the faithful and also disturb the listener to hear it. If any person […] unearths selected graves […] cutting limb by limb […] and following this place the limbs immersed in water to be cooked; and finally, with the covering of meat boiled off from the

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[16] Alexandra Mavrodi and George Paraskevas, "Mondino de Luzzi: a luminous figure in the darkness of the Middle Ages," *Croatian medical journal* 55, no. 1 (2014): 51, doi:10.3325/cmj.2014.55.50.

[17] Often compared to breath, seen in Galenic medicine as a necessary essence that forms in the heart and flows up to the brain, where it transforms into animal spirits.

[18] Alexandra Mavrodi and George Paraskevas, "Mondino de Luzzi: a luminous figure in the darkness of the Middle Ages," *Croatian medical journal* 55, no. 1 (2014): 51, doi:10.3325/cmj.2014.55.50.

[19] The large body of work on dissection generally attributes this to an edict from the 1163 Council of Tours, "ecclesia abhorret a sanguine", or "the church abhors blood". Later scholarship has been unable to find an adequate church document either noting or referencing this edict. A 1978 paper by Darrel Amundsen provides the evidence and overview for this claim. Darrell W. Amundsen, " Medieval Canon Law on Medical and Surgical practice by the Clergy," *Bulletin of the History of Medicine* 52, no. 1 (1978): 27-30, http://www.jstor.org/stable/44450442.

bones, […] export [these] items that ought to be buried."[20] At the time, boiling bones to remove the flesh, or "plac[ing] the limbs immersed in water to be cooked" was common practice when preparing bones for medical study.[21] The use of "cutting" when referring to the treatment of the dead can be taken as the physicians knife, opening and laying the body out for inspection. Boniface appears to be prohibiting an anatomical dissection of the dead, which is the interpretation used by most sources.[22] However, Katharine Park, the Radcliffe Professor of the History of Science at Harvard University, asserts that Boniface is actually prohibiting a grislier funerary practice where the flesh is removed from the bones to allow for easier transportation of the remains. During the Crusades, many soldiers wished to be buried in their native lands, so a common practice was to dismember and boil the body, then "export the items that ought to be buried", items referring to the bones. While "De Sepolturis" is commonly cited as a prohibition of dissection in medieval Europe, a closer reading reveals no formal ban on dissection, merely a legal gray area and a strong dislike by the Church of dismemberment.[23]

The legal status of dissection was only clearly defined by Holy Roman Emperor Frederick II (1194-1250), who was, interestingly enough, excommunicated six times.[24] A 1238 decree by the emperor legalized anatomy, allowing one dissection every five years for medical

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[20] Boniface VIII, *Detestandae Feritatis,* trans. Ben Peterson, 1299.
[21] Thomas Merrigan, *Anatomy,* (Robert Appleton Company, 1907); The Catholic Encyclopedia 1, 2022. http://www.newadvent.org/cathen/01457e.htm.
[22] Darrell W. Amundsen, " Medieval Canon Law on Medical and Surgical practice by the Clergy," *Bulletin of the History of Medicine* 52, no. 1 (1978): 28-29, http://www.jstor.org/stable/44450442.
[23] In a 1995 paper, Professor Park attributes Boniface's prohibition of such funerary practices towards an ideological difference between 13th century Italy and Northern Europe, pointing out that nobles in modern day Germany, England, and France regularly requested that their remains be eviscerated to facilitate transport. In this light, Boniface's Papal Bull condemning such practices is an "exaggerated expression of Italian discomfort with Northern funerary customs". Katharine Park, "The Life of the Corpse: Division and Dissection in Late Medieval Europe," *Journal of the History of Medicine and Allied Sciences* 50, no. 1 (1995): 122, http://www.jstor.org/stable/24623559.
[24] Franz Kampers, *Frederick II.* (Robert Appleton Company, 1909); The Catholic Encyclopedia 6, 2022. http://www.newadvent.org/cathen/06255a.htm.

study in the Universities.[25] It was under this law that the first medieval record of an autopsy emerges, with the writer Salimbene describing a dissection by a doctor in Cremona in 1286.[26] Mondino de Liuzzi performed his dissections at the University of Bologna under the same law, beginning in 1315.[27]

For the majority of the history of anatomical science, the subject on the dissection table was most often an executed male criminal. Occasionally, when corpses were hard to come by, anatomists resorted to grave robbing, but for the most part, only the convicted fell under the knife. This is attributed to an element of Catholic doctrine expunged with the Reformation, that tied the maltreatment of the body directly after death to a condemnation of the soul.[28] In Renaissance Italy especially, dissection was a fate worse than death, a punishment that went beyond the corporeal plane.[29] The prominence of this belief provides an interesting juxtaposition to the willingness of the Italians to open up the dead.[30] While cultural attitudes towards death and burial are often fluid and vary with geographic location and time, it was only two hundred years earlier that Pope Boniface VIII displayed a "mediterranean sensibility"[31] in prohibiting the violation of a corpse by cutting and boiling.[32] Despite this contradiction, Italy was a center of European learning and medicine in the Renaissance, with Italian universities being the first to

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[25] Sanjib Kumar Ghosh,"Human Cadaveric Dissection: a historical account from Ancient Greece to the Modern era," *Anatomy, Cell, Biology* 48, no. 3 (2015): 154, doi: 10.5115/acb.2015.48.3.153.
[26] Katharine Park, "The Life of the Corpse: Division and Dissection in Late Medieval Europe," *Journal of the History of Medicine and Allied Sciences* 50, no. 1 (1995): 111, http://www.jstor.org/stable/24623559.
[27] Abdul Haq Compier, "Rhazes in the renaissance of Andreas Vesalius," *Medical history* 56, no. 1 (2012): 14, doi:10.1017/S0025727300000259.
[28] Ruth Richardson, *Death, Dissection and the Destitute.* 2nd ed., *(*Chicago: The University of Chicago Press, 2000), 15.
[29] Cynthia Klestinec, *Theaters of Anatomy* (Baltimore: The John Hopkins University Press, 2011), 14.
[30] Katharine Park," The Criminal and the Saintly Body: Autopsy and Dissection in Renaissance Italy," *Renaissance Quarterly* 47, no. 1 (1994): 12, https://doi.org/10.2307/2863109.
[31] Katharine Park, "The Life of the Corpse: Division and Dissection in Late Medieval Europe," *Journal of the History of Medicine and Allied Sciences* 50, no. 1 (1995): 130, http://www.jstor.org/stable/24623559.
[32] Katharine Park," The Criminal and the Saintly Body: Autopsy and Dissection in Renaissance Italy," *Renaissance Quarterly* 47, no. 1 (1994): 4, https://doi.org/10.2307/2863109.

mandate the witnessing of a dissection to achieve a doctorate in medicine. The academic curiosity surrounding science, mathematics, and classical work, extended into the medical fields , and were a prevalent topic of discussion in Italian universities.

The biblically high death toll of the black plague, and the consistent inability of physicians to treat it revealed enormous gaps in the general medical and anatomical knowledge available. Both the reentry of Greek and Roman works into Europe by way of the Middle East and the increasing numbers of liberal arts universities created a push for the revival of classical knowledge and teachings, and an expansion of existing knowledge, ushering in the Renaissance.[33] Similarly, the resolution of the ambiguous legal status of dissection by Frederick II and the increasing influence of de Liuzzi's own anatomical findings flung the door open for an increase in academically sponsored and legally sanctioned dissection.[34]

Conducted several times a year during the winter months, when the cold slowed the decomposition of the corpse, prominent Italian universities such as the ones in Padua, Bologna, and Rome, erected temporary stages and risers for formal anatomical dissection, which were highly regulated by university statute.[35] Such regulations included laws on the timing of the dissection, the procurement and burial of the cadaver, and provided qualifications for the entry of spectators into the event. The University of Padua stipulated that dissections were only to be held "after studies have begun and before the end of February".[36] The statutes also called for the election of two *massarii anathomiae* (the *depositarii* in Rome), students of medicine who had

[33] Matthew Vannelli, "A New Outlook: The Roots of Renaissance Italy" (presentation, Portland, OR, November 10).
[34] Klestinec, Cynthia. *Theatrical Dissections and Dancing Cadavers: Andreas Vesalius and sixteenth-century popular culture.* Ann Arbor: UMI Microform, 2001), 7.
[35] Ibid, 22.
[36] The University of Pisa shared a similar statue, that only allowed dissections during "wintertime", but the Universities of Rome and Bologna had no such law, although their dissections followed convention and usually occurred during the winter months. Andrea Carlino, *Books of the Body: Anatomical Ritual and Renaissance Learning*, trans. John Tedeschi and Anne C. Tedeschi (Chicago: University of Chicago Press, 2000), 79.

witnessed several dissections themselves, and were responsible for arranging a venue and subject for the dissection.[37] They were also charged with "overseeing that no student, unless he has matriculated and has been enrolled in medicine for at least one year, should be admitted"[38] This allowed only adult men affiliated with the University to enter, who were required to pay a tax to view the event. The rules governing the setup as well as admittance into the actual event were strict, but pale in comparison to the formalized structure of the physical dissection.

Following established tradition, the actual arbiters of the event were the *lector, ostensor* or *demonstrator,* and the *incisor.*[39] The *lector* or extraordinary professor, began with a reading from Galen's original Latin text, followed by de Liuzzi's *Anothomia* and Avicenna's *Canon of Medicine.*[40] The *ostensor* often translated the Latin into the vernacular, and indicated to the *incisor*, a surgeon or barber who usually knew no Latin, where to cut so that the appearance of the body illustrated and confirmed the text of the *lector.*[41] The dissection was then followed by the *disputatio,* a discussion amongst the students and faculty in attendance of both the reading and displayed body. It served to facilitate learning for the students, similar to class discussions utilized in universities today, but also to confirm the authority of the text. The Italian universities followed a system that placed the faculty in each department, theoretical or practical, in decreasing order of importance in terms of salary and prestige. The highest positions were those of the first and second ordinary lectors, and below them the first, second, and third extraordinary lectors.[42] The statutes of the University of Padua concerning dissection directly state that the

[37] Andrea Carlino, *Books of the Body: Anatomical Ritual and Renaissance Learning*, trans. John Tedeschi and Anne C. Tedeschi (Chicago: University of Chicago Press, 2000), 80.
[38] Ibid, 83-84.
[39] See Appendix Image 1.
[40] Cyntha Klestinec, *Theaters of Anatomy* (Baltimore: The John Hopkins University Press, 2011), 20.
[41] Ibid, 21.
[42] Andrea Carlino, *Books of the Body: Anatomical Ritual and Renaissance Learning*, trans. John Tedeschi and Anne C. Tedeschi (Chicago: University of Chicago Press, 2000), 86.

lector was to be chosen from the extraordinary faculty, the ones who lacked prestige within the University. It is important to note that while in Rome, the *lector* played the main role in the dissection, orchestrating and guiding the whole process, it was the *ostensor,* one of the full fledged Professors of Medicine, who was the principal actor in Paduan dissections.[43] Although an important distinction when discussing the specifics of a dissection, the regional differences between who controlled the dissection did not affect the general model of a reading, a display, and then a discussion.[44] Often referred to as the quodlibetarian model, the rigid procedural format of Paduan dissections originated with the procedure outlined by de Liuzzi in his *Anothomia,* and continued until the late 16th century.[45]

This model of dissection, where the express purpose is to manipulate the cadaver to confirm the text, enforced the views of Galen so prevalent in medical theory at the time, to the point of dogma. Any differences discovered within the corpse, such as a a four lobed liver when Galen described five, were attributed to physical abnormality on the part of the criminal corpse rather than an error by Galen. The central figure in the dissection, the *ostensor,* or *lector* in Rome, never touched the cadaver and instead spoke from a high lectern on Galen and other anatomists who upheld him. The only person in the whole affair to touch the body was the *incisor,* usually a barber-surgeon, who lacked university education. Because they held the lowest importance out of anyone there and were not a full fledged faculty member, the barber-surgeons carried out the dirty work of actually cutting and manipulating the corpse. This system places an emphasis on listening and observing, where the most important piece of the dissection is the

[43] Ibid.
[44] Ibid, 13.
[45] It is interesting that there was such a physical separation between the person in charge of guiding and providing the lesson encapsulated in the dissection, the *ostensor*, and the man elbow deep in the actual cadaver, the *incisor.* The *lector* was seated high above the corpse, the *ostensor* often beside him, where they were easily audible to those in attendance, whereas the *incisor* was in the lowest portion of the room, next to the body on the table.

reading of Galen or Avicenna or de Liuzzi, rather than the body open upon the table. The dissections of the early 16th century were less explorations into the structure and function of the human body, and more ritual demonstrations of already written works, meant to provide a visual example for the medical student.

The use of dissection as a gory example for the student was challenged in the mid 16th century in, ironically enough, an anatomical textbook. Andreas Vesalius, the Belgian anatomist who translated Rhazes's *Kitab al-Mansuri* into Latin, held the position of a lecturer of surgery at the University of Padua, his alma mater, from 1537 to 1544. During this time, he published his seminal work, *De Humani Corporis Fabrica Libri Septem,* or 'On the Fabric of the Human Body in Seven Parts", which was composed of highly accurate and detailed anatomical drawings taken from his own experience as a *demonstrator*.[46] Illustrated by Jan van Calcar, it featured some of the most accurate depictions of human anatomy to date.[47] In it, Vesalius questions Galen's teachings and authority, a bold move in a time when Galen's accuracy on human anatomy had gone largely unquestioned for 1800 years.[48] Avicenna and de Liuzzi had both contradicted Galen, but still treated him as the main authority on the subject. Professor Andrea Carlino of the University of Geneva describes Vesalius's criticisms as being both against Galen and his foundation of knowledge, but also the anatomical ritual his fellow doctors practiced, the dogmatic recitations of Galenic textual authority.[49] In other words, he challenged the methodology in use during dissections, and passionately so. In a 1546 letter, he writes "They ought to be grateful to me as the first who has dared to attack man's false opinions, to lay bare

[46] Andrea Porzionato et al.,"The Anatomical School of Padua," *The Anatomical Record* 295 no. 6 (2012): 902-916, https://doi.org/10.1002/ar.22460.
[47] See Appendix Image 2 and Image 3.
[48] Andrea Carlino, *Books of the Body: Anatomical Ritual and Renaissance Learning*, trans. John Tedeschi and Anne C. Tedeschi (Chicago: University of Chicago Press, 2000), 199.
[49] Ibid, 200.

the extraordinary fraud of [Galen] and to provide our contemporaries with an unusual opportunity for searching out the truth".[50] This passage reveals Vesalius's ire with current anatomical practices, condemning the "extraordinary fraud of Galen" (that Galen's work was fundamentally inaccurate due to its origin in comparative or animal anatomy), as well as indignation that his peers lacked gratitude for Vesalius's "attack [on] man's false opinions […] and provid[ing] [an] unusual opportunity for searching out the truth".[51] An example of Galen's inaccuracies that he repudiated was his description of the uterus, which more closely resembled a dogs with its narrow higher portion, than Vesalius's much more human description of a structure that broadened before narrowing.[52]

Vesalius's outspoken condemnation of Galenic theory as inaccurate, and of Galen himself as foolish for his inaccuracy, did not make him many friends. By proxy, he directed the same criticism of idiocy and inaccuracy at all the blind followers of Galen, which was almost every practicing physician and Professor. Following the release of *Fabrica* others began publishing their own critiques and refutations, such as the *Vaesani*[53] *cuiusdam calumniarum in Hippocratis Galenique rem anatomical depulsio* (1552) of his former teacher Jacobus Sylvius (1478-1555) , and the *Apologia in anatome pro Galeno, contra Andream Vesalium Bruxellensem* (1562) by Franciscus Puteus (1511-1581).[54] Yet others published in support of his ideas, such as Gabriele Falloppio (1523-1562) who held the University of Padua's Chair of Surgery following

[50]Mark E. Silverman M.D., "Andreas Vesalius and *de humanis corporis fabrica," Clinical Cardiology* 14, no. 3 (1991): 278, https://doi-org.proxy.lib.pdx.edu/10.1002/clc.4960140320.
[51] Andrea Carlino, *Books of the Body: Anatomical Ritual and Renaissance Learning*, trans. John Tedeschi and Anne C. Tedeschi (Chicago: University of Chicago Press, 2000), 200.
[52] Fabio Zampieri et al.,"Andreas Vesalius: Celebrating 500 years of dissecting nature," *Global cardiology science & practice* 5 no. 66 (2015): 8, doi:10.5339/gcsp.2015.66.
[53] An allusion to Vesalius and a clever pun on 'Vesalius' and 'insane' in one.
[54] Andrea Carlino, *Books of the Body: Anatomical Ritual and Renaissance Learning*, trans. John Tedeschi and Anne C. Tedeschi (Chicago: University of Chicago Press, 2000), 207.

the departure of Vesalius.[55] Although he was met widely with dissent, his publication of the revolutionary *Fabrica* is credited with provoking a shift away from Galen's long upheld anatomy. This is demonstrated in expansions upon Galen's previously untouched theories, or in Vesalius's case, the eventual replacement of several of Galen's descriptions with ones of increasing accuracy.

Another one of his main criticisms, that current anatomical practices were ritual in nature, is an extension of Vesalius's strong belief in the necessity of the doctor to handle the corpse.[56] Vesalius states this in *Fabrica* directly, writing:

> "I strive that public dissection be carried on as much as possible by the students so that […] there is always some unskilled person who is willing and eager to undertake dissection at the slightest suggestion, [who] if called upon to dissect a cadaver before a throng of spectators can conduct the anatomy correctly with their own hands".[57]

The Italian practice of quodlibetarian dissection seems to have grated on Vesalius, to have the lowest ranking person there, the *incisor*, be the only person to touch the body, and the students themselves withheld from tactile investigation of the corpse. In the opening pages of the *Fabrica,* Vesalius actually criticizes the *ostensor* for "croaking"[58] his lecture from up high in his chair, and not next to the object of the dissection itself.[59] Vesalius expressed a desire to condense the roles of the *incisor* and *ostensor* into one, so that the person who chose the direction and lesson of the dissection also revealed the inner workings of the body through his own hand.[60] While this reform was not achieved during his tenure at the University of Padua, his former colleague

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[55] Cyntha Klestinec, *Theaters of Anatomy* (Baltimore: The John Hopkins University Press, 2011), 55.
[56] Andrea Carlino, *Books of the Body: Anatomical Ritual and Renaissance Learning*, trans. John Tedeschi and Anne C. Tedeschi (Chicago: University of Chicago Press, 2000), 200.
[57] Cyntha Klestinec, *Theaters of Anatomy* (Baltimore: The John Hopkins University Press, 2011), 32.
[58] Ibid, 35.
[59] Ibid.
[60] Ibid, 25.

Falloppio would accomplish what Vesalius had hoped for in 1555, when the University granted him permission to serve as both *incisor* and *ostensor* .[61] It is important to note that this particular reform only applied to Falloppio, and when Fabrici d'Acquapendente or Hieronymous Fabricius (1533-1619) succeeded him as Chair of Surgery in 1566, the dissection returned to the lecture based quodlibetarian model.[62],[63] Despite this, the following half century saw a slow degradation of the barriers between the two roles, and an increasing focus on the arbiter of the lesson being the one to physically handle the corpse.

Although the university was the official center of dissection, private demonstrations for the curious medical student were held by physicians and professors in private hospitals and homes. While the public dissections followed ritual textual tradition with their rigid structure, private dissections allowed the anatomist to explore the cadaver beyond what Galen had written on, and pursue their own theories and research, hands on.[64] Although legally sanctioned within the statutes of the university, the corpses of executed criminals could be hard to come by, and the private anatomist occasionally resorted to body snatching.[65] A fair portion of the illustrated woodcuts in the *Fabrica* were based on stolen cadavers, which Vesalius himself documented in a lurid, and consequently deleted passage of the *Fabrica.*[66] The private dissection served as a

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[61] Ibid.

[62] The movement away from the innovation of Falloppio's demonstrations did not sit well with the students, a collection of Germanic students studying at the University at the time filed detailed lists of complaints when it came to the lack of accuracy and audience interest in Fabricius's more traditional dissections. Cyntha Klestinec, *Theaters of Anatomy* (Baltimore: The John Hopkins University Press, 2011), 58.

[63] Ibid, 57-59.

[64] Because the private setting lacked the rigid structure of the public anatomy, the doctor providing the demonstration both lectured and dissected the corpse himself, usually without an accompanying reading of Galen, Avicenna, or de Liuzzi.

[65] Katharine Park," The Criminal and the Saintly Body: Autopsy and Dissection in Renaissance Italy," *Renaissance Quarterly* 47, no. 1 (1994): 19, https://doi.org/10.2307/2863109.

[66] The passages described in amused detail the lengths to which Vesalius and his students went to procure a steady supply of corpses, with special attention paid to the female dead. Dr. Park offers one such example of the theft of the dead mistress of a monk of Sant'Antonio, where her body is taken and "industriously flayed" following her death due to complications in childbirth. Katharine Park," The Criminal and the Saintly Body: Autopsy and Dissection in Renaissance Italy," *Renaissance Quarterly* 47, no. 1 (1994): 19, https://doi.org/10.2307/2863109.

visceral venue for experimentation and questioning throughout the mid 16th century where the Professor both delivered the lesson, and conducted the physical dissection himself.[67]

Under the ever growing influence of Vesalius's *Fabrica,* the temporary shift in the traditional dissection model achieved by Falloppio, and the increasing attendance of private dissections, the public model of dissection in the late 16th century began to shift from a textually confirming ritual to something more exploratory. Galen's work was still read, but the *ostensor* (usually Fabricius as Chair of Surgery) had begun to isolate specific areas of the body for inspection, in addition to providing a visual aid for the text. In 1574 Fabricius confirmed, and later published on, the existence of valves within the veins of the body, which he referred to as *ostiola* or 'little doors'.[68] He explains his success in detecting them where other anatomists had failed in his publication on the subject, *De venarum ostiolis*, saying "Either they [the *ostensor*] neglected to investigate the function of the doors, a matter […] of primary importance […] or they failed to see them in in their actual demonstration of veins".[69] Fabricius offers two reasons for his predecessors failures, that they offered poor directions to the *incisor* and were unobservant ("failed to see [the *ostiola]* in their actual demonstration"), or that they saw no reason to investigate the venous doors in the first place. Fabricius credits a lack of questioning on the part of the physician who neglected to ask why there was a need for valves in the first place, perhaps due to the strong influence of Galen's writings in medical theory and the absolute faith doctors were taught to take his work in. Fabricius deduced that valves were necessary to control

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[67] Ruth Richardson, *Death, Dissection and the Destitute.* 2nd ed., *(*Chicago: The University of Chicago Press, 2000), 30.
[68] Emerson Thomas McMullen, "William Harvey and the Discovery of the Blood's Circulation," Georgia Southern University. 1998, https://sites.google.com/a/georgiasouthern.edu/etmcmull/william-harvey-and-the-discovery-of-the-bloods-circulation?pli=1.
[69] Cyntha Klestinec, *Theaters of Anatomy* (Baltimore: The John Hopkins University Press, 2011), 2.

the flow of blood, which is largely correct.[70] He explained it as a failsafe to prevent the blood from rushing too quickly too the extremities, whereas the actual function of the valves is to prevent the back flow of blood into the heart.[71] His deduction of a previously unknown but necessary piece of anatomy, and his subsequent efforts to isolate, document, and explain said structure exemplified a shift in anatomy started by Vesalius, which focused less on the cause and effect recitation of Galen's work, and more on further, detailed research which included the purpose and function of the structure itself. Vesalius also emphasized hands on dissection, and while Fabricius is described as "demonstrating",[72] the literature is somewhat vague as to whether or not he was the one wielding the knife. The general assumption appears to be that he could, and did, dissect, ostensibly in private anatomies, but his official role in the public university dissection is unclear. Also unclear is the extent to which he utilized Vesalius's *Fabrica* during the formal dissection, although it can safely be termed a supplementary text for all medical students at the time.[73] Despite the uncertainty, the nature of Fabricius's dissections as Chair of Surgery uphold and perpetuate the movement away from Galen for a increasingly exploratory mode of dissection.

A significant alteration of the anatomical dissection was well under way in the 1590s. From the ritualistic recitation of past anatomical greats, to a tool for research where the principal player in the dissection had physical contact with the cadaver, this change was embedded into the medical academic culture with the construction of the oldest permanent medical theatre at the

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[70] Emerson Thomas McMullen, "William Harvey and the Discovery of the Blood's Circulation," Georgia Southern University. 1998, https://sites.google.com/a/georgiasouthern.edu/etmcmull/william-harvey-and-the-discovery-of-the-bloods-circulation?pli=1.
[71] "What are Venous Valves and why are they so important?," Center for Vein Restoration, March 16, 2018, https://www.centerforvein.com/blog/venous-valves.
[72] Cyntha Klestinec, *Theaters of Anatomy* (Baltimore: The John Hopkins University Press, 2011), 25.
[73] Alla Barabtarlo et al. "Vesalius at 500," University of Missouri. 2014, https://library.missouri.edu/specialcollections/exhibits/show/vesalius500/fabrica/the-1555-edition.

University of Padua in 1595.[74] Perhaps intended to regulate the students and further organize the event, the permanent theatre was a project facilitated by Fabricius, and therefore a stage for his particular brand of demonstration.[75] His own research, the questions he utilized to find the *ostiola* and the emphasis he placed on isolating specific structures, became synonymous with the official dissections of the permanent space. By proxy, this helped cement the movement away from Galen, facilitated by Vesalius and continued by Fabricius's own questioning, marking into permanence an allowance of the expansion of Galen's work.

All prior public dissections had been carried out in temporary spaces filled with wooden risers for the attending students, and were transient in nature. The new theatre retained the wood seats, but arranged them in ascending rings around the dissection table, which was situated at the lowest point in the theatre.[76] This funnel like shape focused the attention and light entirely on the cadaver, and the doctor conducting the dissection.[77] Again, the literature is somewhat unclear as to how exactly the roles of *lector, ostensor,* and *incisor* changed, if they did so at all, but the theatre lacks a wooden pulpit for the *ostensor* to lecture from. The architecture of the new theatre helped to embed within the teachings of the university a curriculum that focused on the corpse as the main event, and the nature of a permanent space for dissection emphasized the importance of the practice in a students learning and comprehension. Other European universities soon

[74] Although certainly the oldest surviving anatomical theatre, it was the second one in existence, the first having been built in 1587, also under Fabricius, and in the intervening years, destroyed. The singular source that mentions this event is somewhat unclear, and cites archival Latin manuscripts that were unavailable to confirm this. Cynthia Klestinec, *Theaters of Anatomy* (Baltimore: The John Hopkins University Press, 2011), 59.
[75] Cynthia Klestinec, *Theaters of Anatomy* (Baltimore: The John Hopkins University Press, 2011), 52.
[76] Sallie Lewis Longoria, "Visit the World's Oldest Anatomical Theater," National Geographic, September 28, 2018, https://www.nationalgeographic.com/travel/article/padua-oldest-permanant-anatomical-theater.
[77] See Appendix Image 4.

followed suit, with the University of Bologna constructing their own theatre in 1595, as well as the University of Leiden in 1597.[78],[79]

The history of dissection in Italy is a long and varied one. The official endorsement of medical anatomies by Frederick II in 1238 and the subsequent publishing of de Liuzzi's *Anothomia* brought anatomy into the academic realm. The quodlibetarian model of dissection outlined by de Liuzzi would persist until Vesalius, and his outspoken complaints in *Fabrica,* provoked a change. The ritual of the pre-Vesalian dissection was heavily grounded in the reading of Galen, and the reinforcement of his somewhat inaccurate anatomy and structure of the body. Following Vesalius, and his blatant criticism of both Galen and the separation of the cadaver and the *ostensor,* the rigid format of the dissection began to dissolve. The purpose of the dissection changed as well, from a visual reinforcement of old lessons to a setting for practical experience in dissection and surgery. The event itself moved away from the blind acceptance previously given to Galenic theory, and placed growing emphasis on drawing conclusions from visual evidence within the body. These changes were immortalized with the construction of a theatre dedicated specifically to this new breed of dissection, which secured them a place in the curriculum of the university, and medical attitudes at large.

The majority of the sources documenting the growth of dissection reference the anti-dissection policy of the Catholic Church, citing Pope Boniface's 1299 Bull 'De Sepolturis' as evidence of the Church's dislike. As described above, this interpretation is inaccurate and reflects a surface level of research, and therefore calls into question the veracity of other facts within the article. The majority of the primary sources are drawn from Professor Carlino's *Books*

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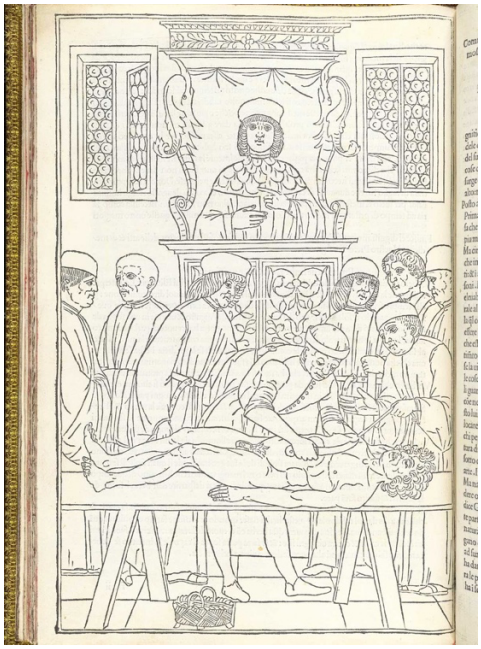
[78] Sanjib Kumar Ghosh,"Human Cadaveric Dissection: a historical account from Ancient Greece to the Modern era," *Anatomy, Cell, Biology* 48, no. 3 (2015): 154, doi: 10.5115/acb.2015.48.3.153.
[79] Sallie Lewis Longoria, "Visit the World's Oldest Anatomical Theater," National Geographic, September 28, 2018, https://www.nationalgeographic.com/travel/article/padua-oldest-permanant-anatomical-theater.

of the Body: Anatomical Ritual and Renaissance Learning, which draws from original Latin sources archived in Italy. The version of the book used is an English translation of its native Italian, so the sources quoted have been translated from Latin to Italian to English, and there is the distinct possibility of some context and accuracy being lost along the way, although no inconsistencies to suggest so.

The growth of anatomical practices in 16th century Padua, although a reflection of Italian anatomy at large, ingrained dissection as the tool for inquiry and analysis it is today. Similarly, the increasing divergence from the quodlibetarian model that allowed for more freedom in the dissection itself was crucial to the expansion of human anatomical knowledge, and with it, diagnoses and treatments. The dissection would prove to be a valuable tool for understanding, used to discover and diagnose, in life and death. Information gleaned from the corpses of the convicted could be used to diagnose the living, and from that, synthesize a treatment. The method in which this knowledge was acquired would prove invaluable as well, specifically in its alteration. The change from manipulating the evidence to match the theory to using he evidence to derive a new theory helped form the basis of the scientific method, a crucial tool in its own right. The permanent theatre enshrined this evidence based model within accepted forms of thought, and paved the way for the scientific discoveries of the Renaissance, Enlightenment, and beyond.

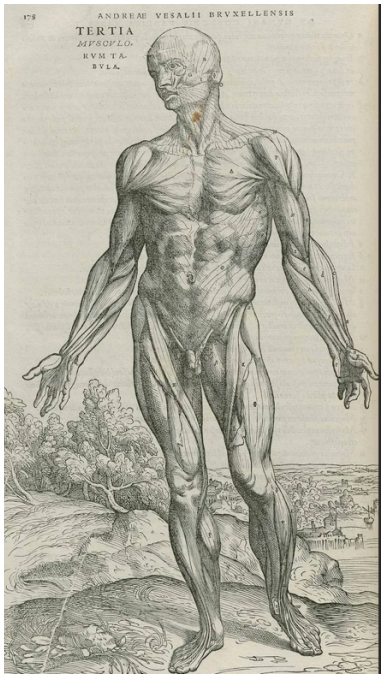
Appendix

Image 1



de Ketham, Johannes. *Fasiculo de Medecina.* 1495. Venice, Italy.

Image 2



van Calcar, Jan. *De Humani Corporis Fabrica Libri Septem.* 1543. Basel, Switzerland.

Image 3

van Calcar, Jan. *De Humani Corporis Fabrica Libri Septem.* 1543. Basel, Switzerland.

Image 4

Bisello, Marco. *Theatre Anatomique Padoue.* 2006. Padua, Italy.

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