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Cover Page Footnote

I want to thank the professors who have watered me with their knowledge and fed me with critiques which resulted in my growth as a historian and writer. This paper is also dedicated to a dear friend who, without their support, this project would not have come to fruition.

SURGERY AS A SCIENCE: THE INTELLECTUAL AND PRACTICAL EVOLUTION OF EUROPEAN SURGERY FROM THE 16TH TO THE 18TH CENTURY

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Abstract

This article explores the transition of surgery from a collection of skills and techniques used on the battlefield to its acceptance as a medical profession. Opinion was shaped through advances in technology, use of anesthesia, and surgical practices. This success prompted a shift in public confidence facilitated by the Church's funding of public autopsies led by surgeons. Once the public understood the greater effectiveness of surgeons, their status changed from butcher to doctor by the early 18th century. Previous research has focused on the technological advances behind the professionalization of surgery and the sociological change in beliefs, but this article will incorporate elements of both.

In the early 15th century, surgery was a skill performed by barbers in which limbs were hacked away or stitched together, a "last-case scenario" for survival, not a serious way to heal the sick. The Church believed surgery was a massacre of God's gift: the body. The public and the Church also thought poorly of the practice because it frequently caused excruciating pain, high mortality rates, and left the patient un-whole. The beliefs of the public, the Church, and physicians changed as a higher rate of public autopsies helped improve knowledge of the body, universities began teaching surgery at a greater rate, and more books were published on the subject. By 1745, surgery had become a medical skill performed by physicians, as evidenced by a split between barbers and surgeons in London. The Company of Barber Surgeons in England and the other Barber-Surgeon guilds in Europe lost status and barbers took on the role with which we associate them today.

Most historians have focused on surgery's technological advances in understanding its transformation from the removal of limbs to a respected

profession.¹ With modern tools and better procedures, surgery became a safer and more reliable procedure. Tony Hunt and Roy Porter, historians of medieval surgery and medicine, discuss the limited scope of technology that was available to barber surgeons in the early 16th century.² When a surgeon was on the battlefield sewing together limbs, there were restrictions as to what could be done with the handful of tools a surgeon could physically carry. Robert Krebs notes that the intellectual productivity of the Renaissance catalyzed new surgical techniques and tools.³ Although the modernization of tools were key to the transformation of surgery, it was not the only reason for surgery's rise in respectability and professionalization.

This article will highlight a number of major technological innovations in surgery in the early modern period, but more importantly, it will explain why these technologies modernized and how they played a role in professionalizing surgery. Existing resources describing the advances in surgical tools and techniques either lack written descriptions of their uses or are beyond my ability to translate. I will answer the above-proposed questions to determine how the melding of technology, society, and culture transformed surgery.

Jesse Dobson and Robert Walker emphasize the rivalry between the Company of Barber Surgeons and the Company of Physicians that appeared in the last quarter of the 1400s.⁴ As barbers became more popular in medical society, physicians tried to maintain their societal prestige by eliminating

¹ Tony Hunt, *The Medieval Surgery* (Suffolk, UK: Boydell, 1992).

Robert E. Krebs, *Groundbreaking Scientific Experiments, Inventions, and Discoveries of the Middle Ages and the Renaissance* (Westport, CT: Greenwood, 2004).

Roderick E. McGrew and Margaret P. McGrew, *Encyclopedia of Medical History* (New York: McGraw-Hill, 1985).

C. J. S. Thompson, *The History and Evolution of Surgical Instruments* (New York: Schuman, 1942).

² Hunt, *Medieval Surgery*.

³ Krebs, *Groundbreaking Scientific Experiments*.

⁴ Jessie Dobson and Robert Milnes Walker, *Barbers and Barber-surgeons of London: A History of the Barbers' and Barber-surgeons Companies* (Oxford: Blackwell Scientific Publications for the Worshipful of Barbers, 1979).

barbers' right to practice certain types of medicine.⁵ Although historians have looked at surgeons' interactions with fellow healers in early modern Europe, they have not investigated how and why surgeons rose in social rank over time. To determine how surgery evolved into a profession, we must look at the influences of multiple factions of society and how they individually and collectively impacted the transformation of surgery.

This article will highlight the shift in public and church opinion towards surgery and how modern tools affected these changes in opinion. Technology cannot advance of its own accord, so this article will examine the reasons leading to innovation and how study of the mysteries of the body played a major role in these movements. An investigation into the culture behind technological advances will help illustrate that it was neither inventions nor culture alone that yielded an environment accepting of surgery as a line of work.⁶ Like the famous chicken/egg conundrum, this article will attempt to determine: "Which caused the professionalization of surgery: technology or culture?" Previous research has stated distinctly that either culture change or modernization of tools were at the apex of surgical professionalization, but this paper will argue it was the intertwined relationship between technological advancements and changes in culture that allowed for surgery to progress into its modern professional, respectable form.⁷

⁵ Sidney Young, *The Annals of the Barber-surgeons of London*. (London: Blades, East & Blades, 1890).

⁶ Mary Lindemann, *Medicine and Society in Early Modern Europe* 2nd ed. (Cambridge, UK: Cambridge UP, 2010).

David A. Lines, "Reorganizing the Curriculum: Teaching and Learning in the University of Bologna, c. 1560–c. 1590," in *History of Universities: Volume XXVI/2*, ed. Mordechai Feingold (Oxford University Press, 2012). <https://doi.org/10.1093/acprof:osobl/9780199668380.001.0001>

George Haven Putnam, *Books and Their Makers during the Middle Ages; a Study of the Conditions of the Production and Distribution of Literature from the Fall of the Roman Empire to the Close of the Seventeenth Century* (New York: Hillary House, 1962).

⁷ Dobson and Walker, *Barbers and Barber-surgeons of London*.

Sherwin B. Nuland, "The Past is Prologue: Surgeons Then and Now," *Journal of the American College of Surgeons* 186, no. 4 (1998): 457-465. [https://doi.org/10.1016/s1072-7515\(98\)00049-0](https://doi.org/10.1016/s1072-7515(98)00049-0)

Thompson, *History and Evolution of Surgical Instruments*.

Growth in the field of surgery began as early as 1560 with increasing demand for surgeons prompting surgical courses to be taught at medical schools and surgical literature to be published at a rapid rate.⁸ *The Annals of the Company of Barber Surgeons of London* and the written documentation of the University of Bologna will be used to determine the extent to which surgery became a profession by the mid-18th century.^{9,10} Specifically, *The Annals* are the closest available primary documentation on the daily interactions of barber surgeons in society and their significance over time. The written curriculum of the University of Bologna from 1560-1590 enables us to see how medical education changed as surgery became more prevalent. The curriculum depicts how surgery became integrated into medical education. These texts will also be used to determine how surgery shifted from the College of Barbers to the Company of Surgeons in 1745. Until the dawn of the 19th century, there was little interest in preserving documentation on European surgery, so few primary documents survive to answer these questions.

Technological Innovations

The profession of a surgeon did not exist in the 16th century as it does today; surgery was instead considered a collection of skills known by a few men that could heal a person.¹¹ The defining factor between the work of a physician and that of a barber surgeon, as surgeons were then called, was the placement of the wound or illness. A physician would handle anything that was happening on the surface of a body, while anything embedded or encased within the body would be treated by a man with the skills to remove the foreign object.¹² Very few barber surgeons lived and worked solely as barber surgeons as surgery was not considered a complete profession, so barbers performed surgical tasks but were not specialized. Butchers were also sought out for surgical help because they were known to be practical with their

⁸ Lines, "Reorganizing the Curriculum."

⁹ Ibid.

¹⁰ Young, *Annals of the Barber-surgeons*.

¹¹ Lindemann, *Medicine and Society*.

¹² Hunt, *Medieval Surgery*.

hands, handling and cutting flesh as a profession.¹³ Because barber surgeons provided other uses that benefitted the town, there were few surgery-specific tools. If a part of the body needed to be opened, anything in the vicinity that got the job done would be used.¹⁴ The local expert on setting a broken leg or removing a kidney stone could also be the neighborhood butcher or craftsman. Surgery's early identity as a skill rather than a profession is significant, as little attention was given it because only a limited number of men performed surgical tasks.

Besides the work done by the local barber in every village throughout Europe, it was on the battlefield that surgery was usually performed during the sixteenth and seventeenth centuries. When war broke out, an influx of new surgical tools and techniques to follow.¹⁵ Men were hired to help the wounded and the speed and agility needed to keep a patient alive caused basic worker's tools to become surgical instruments.¹⁶ According to *A General System of Surgery*, gunshot wounds in the 1680s were, "so much by the heat of the bullets as by the Rapidity with which they destroy the Parts, and the violence of the Symptoms is owing chiefly to this matter of wounding."¹⁷ The battlefield seemed to glorify those that performed surgery, and mark them out in society. Barber surgeons were known because of the gory, painful, and morbid stories told by survivors on the battlefield, and since this was where most surgeries occurred, it became a feared practice by the common man. No one wanted to deal with surgery unless necessary because surgical patients

¹³ Roy Porter, *Blood and Guts: A Short History of Medicine* (New York: W. W. Norton & Company, 2004).

¹⁴ Thompson, *History and Evolution of Surgical Instruments*.

¹⁵ Hunt, *Medieval Surgery*.

¹⁶ R. I. Burns, "The Medieval Crossbow as Surgical Instrument: An Illustrated Case History," *Bulletin of the New York Academy of Medicine* 48, no. 8 (1972): 983-989.

¹⁷ Lorenz Heister, *A general system of surgery in three parts: Containing the doctrine and management, I. Of wounds, fractures, luxations, tumours, and ulcers, of all kinds. II. Of the several operations performed on all parts of the body. III. Of the several bandages applied in all operations and disorders. The whole illustrated with thirty eight copper-plates, exhibiting all the operations, instruments, bandages, and improvements, according to the modern and most approved practice : to which is prefixed an introduction concerning the nature, origin, progress, and improvements of surgery : with such other preliminaries as are necessary to be known by the younger surgeons. Being a work of thirty years experience* (London: Printed for W. Innys at the West-End os St. Paul's, 1743), 51.

who were lucky enough to survive returned home with missing limbs, pain, scars, traumatic memories, and lengthy recoveries. The reputation of a barber surgeon was a grim one. The association between barber surgeons with war, pain, and loss of limb prevented the profession of surgery from progressing.

Although barber surgeons had a grim reputation on the battlefield, they were respected for being crafty and quick-thinking. Barber surgeons had to remember the rules of treating a gunshot wound, which included, “extracting all foreign Bodies, to stop the Heaemorrhage [sic], to promote Suppuration [pus formation], and to encourage new flesh.”¹⁸ Surgeons at the turn of the 16th century were efficient in using anything available as a tool of healing.¹⁹ While clever with tools, barber-surgeons also had to be cognizant of factors other than the wound. An arrow wound would require a surgeon to consider the type of arrow, its position and location, the composition of the arrowhead (if it is was poisoned), and the complications brought on by bleeding, dirt, and pebbles in the wound.²⁰ In the fifteenth and early sixteenth centuries, staunching bleeding while attempting to extract a foreign object was the major conundrum.

In the early sixteenth century, it was anecdotes from witnesses that fed most animosity towards surgery. Barber surgeons were aware of their reputation and tried to hide their instruments and techniques from patients. One such instance can be seen in the creation of issues, or small ulcers in the body, to regulate the health of the patient:

“There is a second method of making Issues by wounding the Skin with a red-hot Iron or actual Cautery, which is usually in a sort of Capsula, or Case of Iron, to conceal it from terrifying the Patient.”²¹

Making holes in patients’ skin to “heal them” is a terrifying proposition, but making those holes with red-hot irons could petrify even the bravest patient. Though the barber surgeon attempted to hide the terrifying truth from the patient, their reaction to the wounding was scarring enough for them or any witness.

¹⁸ Ibid., 52.

¹⁹ Burns, “The Medieval Crossbow.”

²⁰ Ibid., 988.

²¹ Heister, *A general system of surgery*, 314.

As barber surgeons were mainly needed during sudden war or fighting, it was not worth the time or effort to produce new tools when it was unclear when they would next be needed. Nor would it be profitable for a barber surgeon to test out new techniques if very few individuals would call on them for emergencies at home. Barber surgeons were the last resort and they had neither materials nor opportunities for improving their surgical craft.

The introduction of more menacing weapons in battle, like cannons and gunpowder in the mid-sixteenth century, that prompted barber surgeons to develop more efficient tools. Firearms ripped apart limbs, so scalpels gained handles to permit a barber to cut more easily for amputation.²² The speculum, invented by Guy de Chauliac, was upgraded in 1554 when a mirror was attached to it so a surgeon was better able to see if a wound was unsanitary or if a bullet was embedded deep within.²³ This was a much more sterile way of inspecting a wound than prodding and extracting with fingers. Even minor adjustments made to tools allowed for more surgical efficiency and precision. As surgical procedures became more common and better techniques were in higher demand, newer tools were widely adopted, survival rates rose, and the public began to revisit their collective opinion of surgery.

Ambroise Paré was one of the first barber surgeons to modernize surgical tools and techniques.²⁴ While he was working on the battlefield during a campaign in 1536, Paré realized how pointless current surgery was for men wounded by firearms. Surgeons, at a loss, would cut the throats of the wounded rather than attempt to heal them. In disgust, Paré sought ways address wounds caused by cannon.²⁵ He successfully applied rose oil, egg whites, and turpentine on gunshot wounds which became one of his most widely used surgical techniques.²⁶ The mixture dates to the Romans and the day after applying the concoction to a gunshot wound, the injured could sleep the night and their wounds were on the mend. In contrast, men who had boiling oil applied to their wounds, a previously common practice throughout

²² Thompson, *History and Evolution of Surgical Instruments*, 24.

²³ *Ibid.*, 50.

²⁴ Charles B. Drucker, "Ambrose Paré and the Birth of the Gentle Art of Surgery," *Yale Journal of Biology and Medicine* 81, no. 4 (2008): 198-202.

²⁵ *Ibid.*, 198-202.

²⁶ Roy Porter, *The Greatest Benefit to Mankind: A Medical History of Humanity* (New York: W. W. Norton & Company, 1999), 188.

Europe, were feverish from a night of sleeplessness, pain, and swollen wounds. This new method of cleaning gunshot wounds was used widely after word spread on its success. Although he did not create many surgical innovations, Paré's sympathy for the patient's pain and determination that he could improve their conditions influenced other barber surgeons in the mid-sixteenth century to do the same.²⁷

While improvement of tools in the wake of gunpowder and cannon grew more common during the latter half of the sixteenth century, the invention of and practice with better tools and techniques coursed through Europe during the sixteenth and seventeenth centuries.²⁸ At the peak of the Renaissance, advancements in culture encompassed art, transportation, sanitation, and surgery. The forceps, a tool used by surgeons to help pull out a baby during difficult childbirth or to pull out bullets and shrapnel, was invented by a barber surgeon during the late sixteenth century. By the seventeenth century, forceps became one of the key instruments in a surgeon's toolkit. Barber surgeons didn't document the tools they used regularly, but strong correlations exist between commonplace tools in other occupations and the innovations taking place with regard to tools. Wider varieties of a tool may indicate there was enough demand to support creating an array of styles. The minute tweaks that created dozens of different types of forceps and scalpels within several decades in the seventeenth century suggests there were enough barber surgeons, materials, and funding to test and create a wide array of tools.²⁹ More improvements ensued as interest in surgery grew, fueled by a growing desire for knowledge during the Renaissance. This interest could not have materialized unless people began to think more highly of barber surgeons, their craft became imperative, or both.

Another central innovation in technology that led to the professionalization of surgery was the use of anesthesia. Wine and opiates were popular during the Greek and Roman times to render patients unconscious during painful surgeries, but throughout the fifteenth century and up to the beginning of the sixteenth, the use of opiates was rare because most surgeons were unable to gain access to such medicines.³⁰ Instead,

²⁷ Harold Ellis, *The Cambridge Illustrated History of Surgery* (Cambridge, UK: Cambridge UP, 2009), 45.

²⁸ Thompson, *History and Evolution of Surgical Instruments*, 72.

²⁹ *Ibid.*, 72.

³⁰ McGrew and McGrew, *Encyclopedia of Medical History*, 14.

patients were lucky if they had enough wine to sedate them during a painful surgery. Roy Porter states, "Before the introduction of anesthesia in the 1840's, invasive surgery was limited in scope; lengthy operations, or ones demanding great precision, were out of the question."³¹ Because modern anesthesia was not initiated until the nineteenth century, everyday surgery was limited to simple, small-scale and benign actions like dressing wounds, drawing teeth, lancing boils, trussing up ruptures and so forth.³² No one wanted to undergo surgery while conscious, making them unhappy and unwilling to be worked on. Their reputation for bringing pain meant that barber surgeons were not a welcome sight.

Restrictions on riskier and more invasive practices began to loosen at the beginning of the seventeenth century when ingredients other than alcohol to numb a patient became more available. Before the discovery of ether as an anesthetic, opium was widely used if a surgeon had access to it.³³ During the sixteenth century, a soporific sponge was used as a more efficient anesthetic than wine or whiskey. Dipped in a mixture of opium, hyosayamine (a secondary metabolite found in certain plants that settles the stomach and GI tract), blackberries, lettuce seed, hemlock juice, mandragoria and ivy, the sponge was then dried in the sun until it needed to be used for a surgery, when the surgeon would soak it in water and apply to the patient's nose.³⁴ Other similar mixtures were used for inhalation or ingestion, however, the common ingredient between most mixtures was opium.³⁵

If any of the above ingredients were scarce, a surgeon would cut off blood circulation in the carotid artery to cause the patient to lose consciousness.³⁶ This was an effective anesthetic, but how long the patient stayed under and damage cause by compression of the artery was difficult to control. During the eighteenth century, it was also possible to bleed the patient to cause them to faint.³⁷ This was a dangerous practice if large amounts of blood loss were

³¹ Porter, *Blood and Guts*, 80.

³² *Ibid.*, 80.

³³ McGrew and McGrew, *Encyclopedia of Medical History*, 15.

³⁴ *Ibid.*, 14.

³⁵ *Ibid.*, 16.

³⁶ *Ibid.*, 15.

³⁷ *Ibid.*, 14.

expected during the procedure. This was not a successful method of sedation nor was it a pleasing sight for witnesses of the surgery.

Though successful anesthesia was introduced late in the eighteenth century, the previously mentioned methods of sedation, though brutal and uncontrollable, demonstrate the development of surgical skill. If there were enough barber surgeons to test and pass along successful methods for calming a patient and enough surgeries being done to verify techniques, then it can be deduced that surgery started to become accepted as a career during the sixteenth and seventeenth centuries. Sedation increased success for complicated surgeries since the surgeon did not have to worry about holding down a patient or consider their pain threshold. The influence of anesthesia on surgery can be seen in the journal of Timothy Clark, a student of physiology and surgery in 1670s when he discusses the clinical case of a man who lost his spleen after a suicide attempt:

“[After finding the body] the constables were horrified, and left the man for dead, as they believed. For three days, the wound remained without suture, but at last a surgeon was summoned. The surgeon replaced the intestines and cut away part of the omentum, along with the spleen. The man rapidly recovered from the effects of the wound and for the whole of the following year remained in good health and spirits.”³⁸

Earlier in the diary Clark mentioned the patient was put to sleep prior to the surgery. With the anesthetic, the surgery was a success and allowed the patient to survive a trip to New England to start a new life.³⁹ This is one of many clinical cases of complicated surgeries that were possible due to the use of more modern anesthesia. The varied types of anesthetic that appeared during the sixteenth through eighteenth centuries demonstrate how surgical activity evolved from a necessary skill to a successful profession.

The progression of tools and techniques for barber surgeons also supports the assertion that surgery was developing into a widely accepted profession. As instruments evolved into more efficient and controllable tools and better techniques led to more successful recoveries, public opinion of surgery would change. The surviving documentation from this time period indicates that perceptions were beginning to shift. By the middle of the 1550s, there was a huge boom in the invention, and widespread use, of new

³⁸ Ellis, *Cambridge Illustrated History of Surgery*, 45.

³⁹ *Ibid.*, 45.

technologies and techniques that allowed for surgery to become more controllable and successful. With the rapidity of innovation, the modernization of tools cannot be considered merely as an expression of changing times, but as a continent-wide event in which the job of the barber surgeon was evolving into something more acceptable and necessary to society. However, it was not just the tools themselves that evolved, but the opinions and actions of people who stimulated the outgrowth of invention. As tools cannot develop and ideas cannot spread without people creating these ideas and tools, the modernization of surgical tools was not the only influence on the professionalization of surgery.

Changes in Public Opinion and Culture

Advances in surgical technology did not happen overnight, nor did they occur on their own. It was the people behind the inventions of new tools and techniques that fueled the evolution of surgery. Who were these people investing time and energy into modernizing surgery? Why was there a spike in innovation relating to instruments and styles of surgery? Something in society had to have changed to cause this gradual increase and investment in surgical procedures.

This section of this article will look at the different ways public opinion changed towards barber surgeons and their craft, promoting the relevance of surgery in early modern Europe. This section will examine how public opinion first opposed surgery, specifically the Church and the College of Physicians, and why this was so.⁴⁰ Texts focusing on the intellectual advances of surgery will help explain the change in cultural opinion from the mid-sixteenth century until 1745, when surgery was widely accepted as a medical profession.⁴¹ This section will discuss how public opinion sparked changes in culture and technology that resulted in the evolution of surgery.

⁴⁰ Dobson and Walker, *Barbers and Barber-surgeons of London*, 180.
Young, *Annals of the Barber-surgeons*.

⁴¹ Krebs, *Groundbreaking Scientific Experiments*.
Lines, "Reorganizing the Curriculum."
Putnam, *Books and Their Makers*.

Cultural change focuses on overall reactions of a culture or body in society. Changes in culture and the mutability of public opinion are two terms that have been used interchangeably, but this paper will look at each as a separate entity. This paper will demonstrate that surgery had become a necessary cultural component by the late seventeenth century. This includes the acceptance of surgery by medical schools, the boom in surgical publications, and the creation of anatomical theaters. The Company of Barber Surgeons and their interactions with the Company of physicians between 1500 and 1745 will explain how barber surgeons fit into European culture in the early modern period. The changing ideology of the Church (primarily clergy and the ruling bodies of the Christian faith) towards surgery was also significant.

The above aspects of culture and how their change from the sixteenth to the seventeenth century will show how over time surgery became a necessary and significant part of society and was permitted to become its own career. Although the differences between culture and public opinion seem very fine, this article will argue that the modification of public opinion sparked the alterations of culture and technology that allowed for surgery to become a profession.

By 1500, barber surgeons and their craft were perceived negatively throughout the continent. Physicians in northern Europe believed the barber surgeons were not true healers or active participants in the healing process, but rather consultants.⁴² Since many barber surgeons were not educated around 1500, their craft was thought of as healing, but at a menial level below what Europeans believed medicine to be. By 1660, when surgeons were becoming more and more educated, respect for barber surgeons spiked.⁴³ In Paris, surgeons respected the fact that physicians dominated the medical field, but the general population of barber surgeons grew at a steady rate.⁴⁴ In Germany, the opinion towards barber surgery did not improve at a noticeable rate through the nineteenth century because medicine did not advance as quickly as it did in France and England. To the Germans, barber surgeons had a more acceptable role in medical society by performing the hands-on medicine physicians did not care to use.⁴⁵ In the southern

⁴² McGrew and McGrew, *Encyclopedia of Medical History*, 30.

⁴³ *Ibid.*, 30.

⁴⁴ *Ibid.*, 31.

⁴⁵ *Ibid.*, 31.

Mediterranean, householders in Italy, Spain and France left barber-surgeons on the doorstep with other lowly vocations.⁴⁶ Though in Salerno, the medical hub of Europe throughout the Middle Ages, physicians and surgeons were considered equals within the field of medicine and their education was not separated if they attended university.⁴⁷ Given that Salerno was the first medical school, it is not surprising they were the first to follow through with the notion that surgery was indeed a medical skill that a man should attend school to learn.

Although there was an overall negative opinion towards surgery, the seventeenth and eighteenth centuries saw a fundamental change in public opinion towards surgery. Although the research focuses heavily on the seventeenth and eighteenth centuries, I believe the point of transition from a negative to a positive belief in surgical technique started early in the sixteenth century. Granted, there are not sources strongly supporting a change in opinion but a change in the heart of many individuals was necessary for the development of society that allowed for the professionalization of surgery and its development as a discipline.

The significant change in professional opinion towards surgeons is perhaps best exemplified by the inclusion of surgical courses in the medical school at the University of Bologna. Barber surgeons were rarely educated at universities, instead receiving training through apprenticeships and experience, as most medical universities were for physicians. Physicians did not look highly on surgery, nor did they believe it should be considered a part of the field of medicine. However, because of increased public acceptance of surgery and/or the introduction of anatomical theaters into medical study, the curriculum of medicine was beginning to shift. Particularly in the 1660s and 1670s when plague hit England and most of Europe, physicians took up experimentation with surgical techniques to better understand infection. Dr. Richard Mead of England wrote in his *Discourses* on the plague how he wanted to study how the plague and infection worked:

“[I want to investigate] What the effect the bile [of an infected human] would have had, when taken in the Stomach of a Dog: and likewise, what the Result would have been of Injecting into the Veins, other Juices of the body, besides the Bile, and also Matter flowing from the Pestilential Ulcers: For it cannot be certainly concluded, that the Bile

⁴⁶ Ibid., 32.

⁴⁷ Ibid., 32.

would have the same Effect, what ever [sic] Way conveyed into the Body...And perhaps, on the other hand, some other Juices of the Body besides the Bile, particularly the Matter of the Buboës or Carbuncles, injected into the Veins, might have given the Disease; as we see Infection is communicated by the Matter of the Pustules in the Experiment of Inoculating of the Small-Pox.”⁴⁸

When Mead writes this, he is thinking both as a physician and a surgeon, wanting to inject human bile into a dog and study the composition of the dog’s stomach and other organs after it has been killed and dissected. Although Mead wanted to determine how infection acts upon the different humors of the body, a primary focus for physicians, the experiment is very surgical in nature. Testing the effect of fluids being introduced intravenously was normally a surgeon’s method, yet he wants to see the physical affects that the different fluids have on a dog to improve knowledge of a disease usually treated by a physician. This brief excerpt of his dedication in his *Discourses* demonstrates the mindset of a physician during the early eighteenth century, from the perspective of a physician and a surgeon.

Even prior to the outbreak of plague in the 1600s, the University of Bologna was one of the first universities to add surgery to their medical curriculum. In 1560, discussion between professors at the university concluded that surgery should be introduced into courses, like theoretical medicine, since it was starting to show promise as an important technique in the medical and anatomical world. It soon became such a critical point of study that it was given an optional class of its own (like a modern elective). By 1573, a surgical course became the only course available for students in the mornings.⁴⁹ By the end of the 1580s, surgery was a core requirement of the medical curriculum at the University.⁵⁰ Even though this is just a snapshot of the changing curriculum at one university amongst dozens all over Europe, this Italian university (and many of the Italian medical curriculums were copied by those in Paris and England) clearly noticed the importance of surgery as a medical field. Physicians were the lecturers and heads of the medical schools, so adding surgery as a medical course meant that physicians’ opinions towards surgery had fundamentally changed in the

⁴⁸ Richard Mead, *A Short Discourse Concerning Pestilential Contagion, and the Methods to be used to Prevent it* (London: Printed for Sam Buckley, 1720), 10.

⁴⁹ Lines, “Reorganizing the Curriculum,” 12.

⁵⁰ *Ibid.*, 14.

late 1500s. This is demonstrative of an overall shift in doctors' thoughts on surgery which ultimately led to an accepted position for surgery in the medical world of Europe by the early eighteenth century.

As the opinions of medical professions started to change, the public started to recognize and support the surgical profession. In Paris, King Louis XIV became a major patron of surgery in the seventeenth and early eighteenth century. In 1724, the personal success of popular surgeon Georges Mareschal at the Charite Hospital in Paris led to a government grant that established the School of Surgery in Paris (L' Ecole de Chirurgie).⁵¹ Similarly, when the medical school was established at the University of Edinburgh in 1724, it was one of the only universities to include surgery as a field of study, offering a degree in surgery. Mareschal received funds to create the Royal Society of Surgery in 1748.⁵² These examples illustrate how surgery gained enough funds from the government and the public to create their own societies and schools. This indicates that enough of the public had a positive opinion to recognize the importance of surgery and invest in it. This also means that surgery was becoming such a prestigious field that new rules and regulations made it formal education for surgeons necessary. When once it was not thought appropriate for barber surgeons to get a degree in their surgical craft, it was now thought poorly if they did not. This demonstrates that surgery, by the mid-seventeenth century, was finally an accepted medical profession in early modern European society.

The growth of published texts on the topic of surgery is another important indicator of changing public opinion. The presence of surgical books and pamphlets in society indicates there existed a learned and wealthy people who felt strongly enough about the topic to pay for a surgeon's publication. Surgical texts did not start circulating in European society until the late sixteenth century as new research on the human body and surgical instruments emerged. By the early seventeenth century, when surgeons had to become more educated to be accepted into the Company of Barber Surgeons, books were one of the ways they could gain knowledge on which techniques and tools to use. However, these initial publications were full of inaccuracies. After the texts circulated for a time, further new ideas and findings prompted the publication of more books to provide valid information for the growing surgical population at the dawn of the eighteenth century. One introduction to a surgical text validates this:

⁵¹ Ellis, *Cambridge Illustrated History of Surgery*, 46.

⁵² *Ibid.*, 46.

“If any one examines the best Books, such as the *Microtechnia* of Van Hoorn, the *Operations of Nucke* ect, which were at the time consulted not only by our Surgeons but also by our University Professors for teaching and learning the Art, it will readily appear how imperfect and insufficient they are...”⁵³

As the author of the *General System of Surgery* mentions, there are previous authors on the topic of surgery, but now that there have been more advances in the field, he has the resources and obligation to write a more contemporary work on surgery. In another text, the basics of surgery and the anatomy of the body are provided. For example, the definition of a nerve:

“They are the Organs of Sence [sic], long, round, white Bodies, covered with two Membranes, made of the Dura and the Pia Mater, composed of Fibres. Springing from the Cortical part of the Brain and the Cerebellum”⁵⁴

With surgical texts being published that show the basics of surgical skill and the definition of major components of the body, by the dawn of the eighteenth century (with this particular text published in 1705), surgery had a wide enough audience to allow learned texts written by educated and successful surgeons to circulate throughout Europe.

The culture of surgical texts is important because the more interest people had in the field, the more likely there were patrons to invest in publishing textbooks. As George Putnam states: “The 15th century rediscovered (books of the) antiquity, the 16th century was absorbed in slowly deciphering it.”⁵⁵ While learned scholars and monks were spending time deciphering Greek and Roman texts, it took nearly another two centuries for the surgical texts to appear. With new tools and new techniques circulating and surgical skills starting to be highly prized thanks to the popularity of anatomy and anatomical theaters, interest in surgery grew. Most of the texts from this era were published from 1675 onward.⁵⁶ The significance of this

⁵³ Heister, *A general system of surgery*, vii.

⁵⁴ James Handley, *Colloquia Chirurgica; or, the whole Art of Surgery epitomiz'd and made easie according to modern practice. ... To which is added a compendium of Anatomy* (London: Printed for A. Bettesworth, 1705), 174.

⁵⁵ Putnam, *Books and Their Makers*, 105.

⁵⁶ This is from my experience in looking up primary resources. It is hard to say if it is factually true that the surgical texts that do remain are mostly from the late 1600's into the 1700's.

observation is twofold. First, the field of surgery was significant enough that people thought it profitable and worthwhile to publish solely on the topic. Second, there was enough monetary investment in the publication of these books that multiple editions could be released (*A general system of surgery* by Lorenz Heister, cited in this article, is a third edition of the original text).

In the fourteenth and fifteenth centuries, physicians were the predominant specialists in the medical field.⁵⁷ Although there were a large number of uneducated healers in European society, these healers and the educated physicians had one thing in common: they tried to heal a patient using their mind and knowledge instead of their hands. As Roy Porter states, “The superior physician plumed himself as being marked out by mind, not muscle, brains not brawn.”⁵⁸ For physicians, they counted in book-learning, experience, knowledge, memory and judgment. The common surgeon was depicted as a man of flesh—bold and beefy, holding a knife and a saw, no better than a butcher or a barber.⁵⁹ That is why many barber surgeons held many trades like hair-cutting, butchery, and used their hands for other useful jobs. The Hippocratic Oath itself directed physicians to leave knife-work to surgeons. While this recognized the skills of the surgeon, it bred a division of labor that endured for centuries—surgery was inferior because it was the work of the hand, not of the head.⁶⁰ It was because of this mindset that surgery was an inferior skill to physician’s work that kept surgery at the level of a barbaric skill rather than an esteemed profession.

The Church also had influence over the social standing of surgery in late medieval culture, and this played a significant role in surgery’s perceived unacceptability. To those of Christian faith, the body was pregnant with symbolic meanings. Since it was originally made in God’s image, it was a sacred temple that held the mysteries of the Holy Spirit.⁶¹ To gouge out limbs and hack away at the flesh and blood of God was thought to be an un-Christian thing to do. During the Renaissance, curiosity about the world around us—and seeing how it worked—became accepted and esteemed. It was during the Renaissance that many Christian churches wanted to unfold

⁵⁷ Porter, *Blood and Guts*, 30.

⁵⁸ *Ibid.*, 30.

⁵⁹ *Ibid.*, 30.

⁶⁰ *Ibid.*, 78.

⁶¹ *Ibid.*, 41.

the secrets of the body, and find out where the soul was located in man.⁶² Large artistic projects, like the paintings in the Vatican done by Michelangelo and other artists, focused on perfecting the art of painting the human body. Churches funded the construction of anatomical theaters where routine dissections were held and eager onlookers were able to sit and watch as barber surgeons, who were hired for the job of dissecting the cadavers, unraveled the mysteries of the human body.⁶³ The introduction of anatomical theaters meant that barber surgeons were needed for their surgical skills to fulfill societal demand. This was the first time barber surgeons were building a positive reputation for their work as surgeons as they were recognized by learned society as men who were not just skilled with their hands, but with their knowledge.

Anatomical theaters also provided barber surgeons with the chance to show onlookers the importance of their work. If someone watching a dissection was interested in finding out more about a certain part of the body, they could become a patron of a barber surgeon. However, this was not as significant as the presence of wealthy and knowledgeable physicians who wanted to do more with their work. What emerged was a group called anatomists, who focused solely on specific parts of the body. For example, Andreas Vesalius became a world-renowned anatomist in the 1540s because he was able to study the human body and determine that the works of Galen, an ancient physician whose writings were the cornerstone to medical education for centuries, was based on animal anatomy and not the anatomy of the human body.⁶⁴ Vesalius and many of his followers went on to discover how the circulatory system worked, where the organs lay in the body, what their purposes were, and many other important developments. The advances of anatomical research were key to the success of barber surgeons because the new knowledge allowed for society to understand the importance of the inner workings of the body and introduced new ways to better treat patients. If surgeons know what organ lies where and how it is important to the internal system of the body, then they can better diagnose and fix an ailing patient. Knowing where the major arteries and veins are allows for better prevention of accidentally cutting a patient in the wrong spot. A good

⁶² Lindemann, *Medicine and Society*, 92.

⁶³ Ellis, *Cambridge Illustrated History of Surgery*, 32.

⁶⁴ Lindemann, *Medicine and Society*, 92.

example of the importance of this knowledge can be seen in the anecdotes of Ambroise Paré:

“A sergeant of the Chatelet got a sword thrust in the throat.... It cut the external jugular vein completely across. As soon as he was injured he put a handkerchief on the wound and came to my house to find me. When he removed the handkerchief blood flowed very freely. I immediately tied the vein towards its root; thus it was staunched and he recovered, thanks to God. If you had followed your method of staunching the blood with cauteries (burning the vein to stop bleeding—the “old” way to staunch blood) , I wonder if he would have recovered. I believe he would have died in the hands of the operator.”⁶⁵

Thanks to the growing knowledge of human anatomy, Paré could save his patient by recognizing the vein that was cut by the sword and tying the vein instead of burning it to save his patient. This method spread throughout Europe, soon replacing the once-common technique of cauterizing arteries.⁶⁶

While the acceptance and place of barber surgeons in the sixteenth and seventeenth centuries likely differed amongst European countries, this paper will focus specifically on the role of barber surgeons in English society to illustrate how surgery became its own profession. Not only was the Company of Barber Surgeons in London one of the largest such companies in Europe, their interactions with the Company of Physicians and the public over the centuries were carefully documented and republished.⁶⁷ Their *Annals* can be used to generalize the relationship between barber surgeons and physicians during each century leading up to the separation and legalization of the Company of Surgeons in 1745. This year was pivotal because it marked the first time surgeons, in their own right, had a place in both society and medical culture: the first real example of the professionalization of surgery.

If a group of men had the same job in a large town during the fourteenth and fifteenth centuries, they usually formed a guild, or company, to monopolize the profession and regulate others in the career. In London, the Company of Barber Surgeons was recognized when its first Master, Richard le Barber, was sworn into his position in 1308.⁶⁸ In 1451, the Company of

⁶⁵ Ellis, *Cambridge Illustrated History of Surgery*, 36.

⁶⁶ *Ibid.*, 36.

⁶⁷ Young, *Annals of the Barber-surgeons*, 51.

⁶⁸ *Ibid.*, 51.

Barbers was given the Grant of Arms to undertake surgery as a craft within their guild.⁶⁹ Prior to 1451, any man could lawfully conduct surgeries because it was not a skill monitored under any particular company, but after 1451, any legitimate surgery had to be done by a sworn barber surgeon belonging to the Company of Barbers.

The barber surgeons were able to thrive because they had a number of skills in addition to their surgical set, so citizens were not repulsed by a man whose sole career involved cutting open a man—a barber surgeon was able to provide haircuts and pull teeth.⁷⁰ As Sydney Young wrote:

“The Barbers by the regular and everyday nature of their calling as shavers and haircutters, together with the practice of surgery combined by so many of them, were the most likely to become the more popular Company; their fees would surely be on a lower scale than those of the more aristocratic surgeons and their number and constant intercourse with the citizens, in their capacity as barbers, enabled them easily to extend their connection as surgeons.”⁷¹

Barber surgeons flourished in London during the first half of the sixteenth century. During this time, most of the men in the Company of Barbers had little to no formal education in medical practices. It wasn't until 1540 that the Company of Physicians took notice of these men. Even as early as 1525 and throughout the latter half of the sixteenth century, the Company of Physicians tried to uphold divisions over who within medical society could learn and practice certain types of “physic” (or medicine).⁷²

The growth of the Company of Barber Surgeons indicates interest in the art of surgery, demand for surgeons in London, and increased notice from physicians. With an increased presence in society because of their role in anatomy, barber surgeons were perceived as a threat to the physicians, despite physicians maintaining that there were distinct differences between medicine and surgery. The middle of the sixteenth century also marked the beginning of most of the major inventions and modernizations to surgical tools and techniques, which meant more patients were comfortable with having surgery done and more men could test out new inventions as part of a

⁶⁹ Ibid., 51.

⁷⁰ Ibid., 51.

⁷¹ Ibid., 51.

⁷² Ibid., 125.

larger population within the Company. As more men joined the Company of Barber Surgeons from across England, they could spread their own techniques and ideas more successfully. Either way, there was an increasing demand for surgery that permitted growth within the Company and the techniques they used. Demand for men with these skills ultimately led to the professionalization of surgery by 1745.

Throughout the latter half of the sixteenth century, a number of events reveal the growing importance of surgery in society. The most widely seen indicators were the growing amounts of money demanded from the Company of Barber Surgeons by the royal family and city of London, as well as the placement of barber surgeons in court. In 1525, Henry VIII placed Thomas Vicary as Surgeon to the King to try to help treat the King's ulcerous leg. During the reign of Elizabeth I, a royal surgeon was kept to help with the Queen's ailing teeth in the 1580s and, in 1599, the royal household of Scotland recognized the Faculty of Physicians and Surgeons in Glasgow.⁷³ The hiring of surgeons by the upper class was an important step toward the professionalization of the field. In the annals of the Company of Barber Surgeons, common minutes on the financial demands of the city are as follows:

“29th March 1596. It was ordered that £40 ‘ship money’ should be ‘lent’ by the Company to the City which is the earliest mention of this obnoxious tax in our books.”⁷⁴

It can be seen from this notation that the barber surgeons knew, given the quotation marks around the word “lent” that the city was not going to return the forty pounds that was given to them. The Company must have had enough money to be able to afford this “loan,” or at least had access to people who could dispense the tax. The last part of this note may suggest that the barber surgeons were sick of the taxes put upon their company or they were tired of having to lend out money that was not returned. The fact that the Company could still stay afloat for centuries while the city and the royal court are taking out so many loans shows that the Company of Barber Surgeons was prosperous enough to manage such expenditures. They must have had enough members providing adequate revenue or had ties to wealthy members/patrons. This access to substantial funds to give away to court

⁷³ Ellis, *Cambridge Illustrated History of Surgery*, 36.

⁷⁴ Young, *Annals of the Barber-surgeons*, 107.

exemplifies that the Company was enough in demand to sustain profits and connections.

While it may seem strange that higher taxes and demands for money are correlated with the rising significance of the Society, but it indicates higher expectations of the Company on the part of the royal family. If more men were becoming barber surgeons and joining the Company then there was more money flowing into the guild that could be lent to the royal family and government. If the court was relying on barber surgeons for money, the guild must have had a reputation of having stable enough finances to lend out funds. While the Company could have been demanding extra money from its members for these loans, ultimately leading to bankruptcy (though this did happen in the seventeenth century), at the end of the sixteenth century there were enough existing and new members to keep the Company afloat. If this hadn't been true, the Company would have gone bankrupt sooner and they would have been unable to build the anatomical theater they constructed in 1636 for the advancement of surgery. The fact that the anatomical theater itself was built on the funds of the Company of Barber Surgeons shows the prosperity of its members. Without rapid membership growth, it would have been impossible to afford. To have the funds to build the theater, the culture of London must have changed substantially by 1636 from one that looked down on surgeons to one that needed them. Thus, surgery was becoming an acceptable medical profession, rather than the skill it once was in 1500.

With their newly created anatomical theater and the growing attention paid to barber surgeons by the court, the Company of Physicians recognized the threat of surgeons to their profession. By 1677, the Company of Physicians submitted a charter trying to gain power over the Company of Barber Surgeons. Alarmed and determined to keep the divide between the work of physic (medicine) and the work of surgery, the barber surgeons petitioned the court to keep their freedom. To the dismay of the Company of Physicians, the barber surgeons won the petition. However, from 1677 until 1745, the Company of Physicians kept trying to gain the power to oversee surgery. By 1677, with the skill of surgery taught in major medical schools across Europe, physicians were constantly aware of the growing influence of surgery inside and outside the medical sphere. This continued effort to keep influence in medical society shows that surgeons were gaining ground as competitors to physicians in the medical field.

At the end of the seventeenth century there was a noticeable divide in the Company of Barber Surgeon between the barbers and medically trained surgeons coming out of universities. Rules were passed in the Company to

keep an even distribution of barbers and surgeons in the seats of power within the guild. Of the four ruling “masters” in the Company, two had to be barbers and two had to be surgeons. This rule demonstrates a rise in friction between barbers and surgeons, since a formal law was needed to keep an even distribution in power, and illustrates there was a large enough population of barber surgeons who solely worked as surgeons to be able to demand such a law. Written in the annals of the Company is a note that goes more in depth on the struggles between the barbers and the surgeons of the Company:

“Jealousies arose in the Company in consequence of the more frequent election of Surgeons than Barbers, as Governors. The By-Laws required that every year there should be two Barbers and two Surgeons chosen (a Barber being defined as any member who did not practice Surgery). The Surgeons disregarded the law and the old custom, seem to have been able to procure the election of an undue number of members of their own craft to the offices of Master and Wardens...This altercation between the Barbers and the Surgeons was never forgotten, and indeed, helped to pave the way to further estrangement and the absolute separation in 1745 [this last sentence provided by Young himself].”⁷⁵

This quote shows how the barbers and surgeons were growing apart. The writer even notes the difference between a barber and a surgeon, stating a barber did not practice surgery. This parenthetical notation also exemplifies that at the end of the seventeenth century, when this note was written, the surgeons had created successful professions as just surgeons in the city of London. As Young mentions in the last sentence, the barbers and the surgeons were unable to move beyond this, increasing division between the two groups. The surgeons gained more power and influence in the company (because they were gaining more seats) indicating an increase of societal influence as surgeons were considered part of the medical profession.

In 1686, a formal proposal was sent on behalf of the surgeons to the king petitioning him to allow their separation from the barbers. This declaration is important for two reasons: the surgeons were strong enough to try and claim independence from the barbers and there were enough of them in London to create such a petition. Obviously, their demand for independence demonstrates how surgeons were now trying to establish their own profession. The king did not accept their petition, but they kept trying to gain

⁷⁵ Young, *Annals of the Barber-surgeons*, 149.

independence throughout the early eighteenth century while their influence as a majority of the governing body in the Company of Barber Surgeons kept growing. Finally, in 1745, the Company of Surgeons was established while the Company of Barbers, crippled with debt from loaning most of their money to the crown—were designated as strictly hair cutters.⁷⁶ By 1745, surgery was a strong enough skillset that men were able to get educated on the subject and practice it as a formal profession as part of a trade guild.

The history of the London Company of Barber Surgeons is important to the professionalization of surgery. The power dynamics between the Company of Physicians and the Company of Barber Surgeons and the internal struggles between barbers and surgeons by the end of the seventeenth century also occurred in many major cities all over Europe. The *Annals* of the London Company were easier to access and transcribe, but the split of the Company of Surgeons from the barber surgeons created a ripple effect across Europe. Once the surgeons were established in London, others in Spain, Paris, and various provinces in Italy took similar action and instated their own guilds.⁷⁷

Conclusion

The opinion of the public and the individual directs culture, sparking the professionalization of surgery during the early modern era. If an individual or group of individuals had not noticed the importance of surgery, then culture would not have changed to accept surgery as a necessary part of society and better tools and methods would not have developed. However, the innovation of technology and the change in culture are pivotal to the evolution of surgery from a set of skills into an accepted medical profession. This article establishes how each was necessary to facilitate a drastic transition from the practice of surgery during the turn of the sixteenth century and its practice when the London Company of Surgeons broke away from the Company of Barbers in 1745.

Although this article briefly looks at only a few of the major players with a role in this evolution, its purpose has been to explain how and why the modernization of surgery occurred in the first place and why it happened when it did. It is important to look back at the creation of different

⁷⁶ *Ibid.*, 154-155.

⁷⁷ *Ibid.*, xi.

professions to appreciate and acknowledge the way they fit into modern society. With contemporary surgery a competitive and respected profession in the world of medicine, it is helpful to see how ideas and technologies have evolved to allow for such a profession to grow into its modern form. It is also interesting to see how the interactions between surgeons and physicians played out in the past, causing them to stay two separate careers instead one professional doing both roles. These historical patterns may still be happening now, resulting in the creation of a whole new job or profession that may gain significance in the future. Similar results have occurred for computer professionals and social media advisors with rapid advances in technology and societal opinion. By looking at the reasons careers and professions are created, observers and historians can recognize the significance each has in the context of culture, society, and the world around us.

Future research may identify further documentation to support the conclusions in this article and whether the experiences of the London Company of Barber Surgeons can be generalized across Europe. While the precise evolution of surgery and its professionalization may be unclear in parts, we can better understand the various societal influences that brought forth one of the most essential professions in the medical world.

References

- Burns, R. I. "The Medieval Crossbow as Surgical Instrument: An Illustrated Case History." *Bulletin of the New York Academy of Medicine* 48, no. 8 (1972): 983-989.
- Chamberland, Celeste. "From Apprentice to Master: Social Disciplining and Surgical Education in Early Modern London, 1570-1640." *History of Education Quarterly* 53, no. 1 (2013): 21-44. <https://doi.org/10.1111/hoeq.12001>
- Cook, Harold. *The Decline of the Old Medical Regime in Stuart London*. Ithaca, New York: Cornell University Press, 1986.
- Cowper, William. "An Account of Stitching the Great Tendon, between the Calf of the Leg and Heel, with Its Union and Cure, after an Entire Division of It, with Remarks: Read at a Meeting of the Royal Society." *Philosophical Transactions (1683-1775)* 21 (1699): 153-160.

Dobson, Jessie, and Robert Milnes Walker. *Barbers and Barber-surgeons of London: A History of the Barbers' and Barber-surgeons Companies*. Oxford: Blackwell Scientific Publications for the Worshipful of Barbers, 1979.

Drucker, Charles B. "Ambrose Paré and the Birth of the Gentle Art of Surgery." *Yale Journal of Biology and Medicine* 81, no. 4 (2008): 198-202.

Ellis, Harold, and Harold Ellis. *The Cambridge Illustrated History of Surgery*. Cambridge: Cambridge UP, 2009.

Handley, James. *Colloquia Chirurgica; or, the whole Art of Surgery epitomiz'd and made easie according to modern practice. ... To which is added a compendium of Anatomy*. London: Printed for A. Bettesworth, 1705.

Heister, Lorenz. *A general system of surgery in three parts : Containing the doctrine and management, I. Of wounds, fractures, luxations, tumours, and ulcers, of all kinds. II. Of the several operations performed on all parts of the body. III. Of the several bandages applied in all operations and disorders. The whole illustrated with thirty eight copper-plates, exhibiting all the operations, instruments, bandages, and improvements, according to the modern and most approved practice : to which is prefixed an introduction concerning the nature, origin, progress, and improvements of surgery : with such other preliminaries as are necessary to be known by the younger surgeons. Being a work of thirty years experience*. London: Printed for W. Innys at the West-End os St. Paul's, 1743.

Hunt, Tony. *The Medieval Surgery*. Woodbridge, Suffolk, UK: Boydell, 1992.

Krebs, Robert E. *Groundbreaking Scientific Experiments, Inventions, and Discoveries of the Middle Ages and the Renaissance*. Westport, CT: Greenwood, 2004.

Lindemann, Mary. *Medicine and Society in Early Modern Europe*. 2nd ed. Cambridge, UK: Cambridge UP, 2010.

Lines, David A. "Reorganizing the Curriculum: Teaching and Learning in the University of Bologna, c. 1560–c. 1590." In *History of Universities: Volume XXVI/2*, edited by Mordechai Feingold. Oxford: Oxford UP, 2012. <https://doi.org/10.1093/acprof:osobl/9780199668380.001.0001>

McGrew, Roderick E., and Margaret P. McGrew. *Encyclopedia of Medical History*. New York: McGraw-Hill, 1985.

Nuland, Sherwin B. "The Past is Prologue: Surgeons Then and Now." *Journal of the American College of Surgeons* 186, no. 4 (1998): 457-465. [https://doi.org/10.1016/s1072-7515\(98\)00049-0](https://doi.org/10.1016/s1072-7515(98)00049-0)

Porter, Roy. *Blood and Guts: A Short History of Medicine*. New York: W. W. Norton & Company, 2002.

Porter, Roy. *The Greatest Benefit to Mankind: A Medical History of Humanity*. New York: W. W. Norton & Company, 1998.

Putnam, George Haven. *Books and Their Makers during the Middle Ages; a Study of the Conditions of the Production and Distribution of Literature from the Fall of the Roman Empire to the Close of the Seventeenth Century*. New York: Hillary House, 1962.

Steigerthall, D. R. and J. Niemeyer. "An Account of Two Extraordinary Cases in Surgery: Communicated by Dr. Steigerthall, F. R. S." *Philosophical Transactions (1683-1775)* 31, (1720 /1721): 79-81.

Thompson, C. J. S. *The History and Evolution of Surgical Instruments*. New York: Schuman, 1942.

Webster, Charles. *Health, Medicine and Morality in the 16th Century*. Cambridge: Cambridge UP, 1979.

Young, Sidney. *The Annals of the Barber-surgeons of London*. London: Blades, East & Blades, 1890.