History of Surgery
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Importance of Understanding Surgical History
- Historical Relationship Between Surgery and Medicine
- Knowledge of Human Anatomy
- Method for Controlling Hemorrhage
- Pathophysiologic Basis of Surgical Diseases
- Anesthesia
- Antiseptics, Asepsis, and Understanding the Nature of Infection
- X-Rays
- Turn of the 20th Century
- Ascent of Scientific Surgery

Internationalization, Surgical Societies, and Journals
- World War I
- American College of Surgeons
- Women Surgeons
- African American Surgeons
- Modern Era
- Last Half of the 20th Century
- Cardiac Surgery and Organ Transplantation
- Political and Socioeconomic Influences
- 20th Century Surgical Highlights
- Future Trends

Importance of Understanding Surgical History
It remains a rhetorical question whether an understanding of surgical history is important to the maturation and continued education and training of a surgeon. Conversely, it is hardly necessary to dwell on the heuristic value that an appreciation of history provides in developing an additive humanistic, literary, and philosophic taste. Clearly, the study of medicine is a lifelong learning process that should be an enjoyable and rewarding experience. For a surgeon, the study of surgical history can contribute toward making this educational effort more pleasurable and can provide constant invigoration. Tracing the evolution of what one does on a daily basis and understanding it from a historical perspective becomes ever so pleasurable. In reality, there is no way to separate present-day surgery and one's own clinical practice from the experiences of all surgeons and all the years that have gone before. For the budding surgeon, it is a magnificent adventure to appreciate what he or she is currently learning within the context of past and present cultural, economic, political, and social institutions. The active practitioner will find that the study of the profession—dealing, as it rigidly must, with all aspects of the human condition—affords an excellent opportunity to approach current clinical concepts in ways not previously appreciated.

In studying our profession's past, it is certainly easier to relate to the history of "modern" surgery of the past 100 or so years than to the seemingly "primitive" practices of prior periods because the closer to the present, the more likely it is that surgical practices resemble those of our day. Yet, writing the history of modern surgery is in many respects more difficult than describing the development of surgery before the late 19th century. One significant reason for this is the ever-increasing pace of scientific development coupled with an underlying fragmentation (i.e., specialization and subspecialization) within the profession. The craft of surgery is in constant flux, and the more rapid the change, the more difficult it is to obtain a satisfactory historical perspective. Only the lengthy passage of time permits a truly valid historical analysis.

Historical Relationship Between Surgery and Medicine
Despite outward appearances, it was actually not until the latter decades of the 19th century that the surgeon truly emerged as a specialist within the whole of medicine to become a recognized and respected clinical practitioner. Similarly, it was not until the first decades of the 20th century...
impressive than the agonizingly slow but steady advance of surgery. In a seeming contradiction of mid-19th century scientific and social reality, medicine appeared as the more progressive branch, with surgery lagging behind. The art and craft of surgery, for all its practical possibilities, would be severely restricted until the discovery of anesthesia in 1846 and an understanding and acceptance of the need for surgical antisepsis and asepsis during the 1870s and 1880s. Still, surgeons never needed a diagnostic and pathologic revolution in the manner of the physician. Despite the imperfection of their scientific knowledge, the pre-modern era surgeon did cure with some technical confidence.

That the gradual evolution of surgery was superseded in the 1880s and 1890s by a rapid introduction of startling new technical advances was based on a simple culminating axiom—four fundamental clinical prerequisites that were required before a surgical operation could ever be considered a truly viable therapeutic procedure had finally been identified and understood: (1) knowledge of human anatomy; (2) a method for controlling hemorrhage and maintaining intraoperative hemostasis; (3) anesthesia to permit the performance of pain-free procedures; and (4) an explanation of the nature of infection along with the elaboration of methods necessary to achieve an aseptic and aseptic operating room environment. The first two prerequisites were essentially solved in the 16th century, but the latter two would not be fully resolved until the ending decades of the 19th century. In turn, the ascent of 20th century scientific surgery would unify the profession and allow what had always been an art and craft to become a learned vocation. Standardized postgraduate surgical education and training programs could be established to help produce a cadre of scientifically knowledgeable practitioners. And in a final snub to an unscientific past, newly established basic surgical research laboratories offered the means of proving or disproving the latest theories while providing a testing ground for bold and exciting clinical breakthroughs.

**KNOWLEDGE OF HUMAN ANATOMY**

Few individuals have had an influence on the history of surgery as overwhelming as that of the Brussels-born Andreas Vesalius (1514-1564) (Fig. 1-1). As professor of anatomy and surgery at Padua, Italy, Vesalius taught that human anatomy could be learned only through the study of structures revealed by human dissection. In particular, his great anatomic treatise, *De Humani Corporis Fabrica Libri Septem* (1543), provided a fuller and more detailed description of the human anatomy than any of his illustrious predecessors. Most importantly, Vesalius corrected errors in traditional anatomic teachings propagated 13 centuries earlier by Greek and Roman authorities, whose findings were based on animal rather than human dissection. Even more radical was Vesalius' blunt assertion that anatomic dissection must be completed by physician/surgeons themselves—a direct renunciation of the long-standing doctrine that dissection was a grisly and loathsome task to be performed by a drucker-like individ-

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**Note:**

Anatomist[1] to this point, and to create a foolproof system to prevent the need for follow-up surgery, is to ensure that the surgery is done perfectly the first time. There are several ways to accomplish this, and one of the most important is the use of precision surgical instruments. These instruments are designed to be as close to the natural anatomy as possible, thereby reducing the chances of complications. Additionally, advances in medical imaging technology have allowed surgeons to plan their surgeries with greater precision. For example, pre-operative imaging can identify any underlying problems or abnormalities that may need to be addressed during the surgery. This allows the surgeon to plan the surgery in a way that minimizes the chances of complications and maximizes the likelihood of a successful outcome. Finally, improvements in anesthesia and pain management have made it possible to perform more complex surgeries with less risk to the patient. As a result, the field of surgery has made significant progress in recent years, and the future looks promising for continued improvement.
century that surgery could be considered to have achieved the status of a bona fide profession. Before this time, the scope of surgery remained quite limited. Surgeons, or at least those medical men who used the sobriquet ‘surgeon’ were trained in private apprenticeships, at best treated only simple fractures, dislocations, and abscesses and occasionally performed amputations with disfigurement but also with high mortality rates. They managed to ligate major arteries for common and accessible aneurysms and made heroic attempts at relief of incarcerations. Some individuals focused on the treatment of anal fistulas, hernias, cataracts, and bladder stones. Inexact attempts at reduction of incarcerated strangulated herniae were made, and, hesitatingly, rather rudimentary colostomies or ileostomies were created by simply incising the skin over an expanding intra-abdominal mass, representing the end stage of a longstanding intestinal obstruction. Compound fractures of the limbs with attendant sepsis remained mostly unmanageable, with staggering morbidity and likely surgical outcome. Although a few bold surgeons endeavored to incise the abdomen, hoping to divide obstructing bands and adhesions, abdominal and other intrabdominal surgeries were virtually unknown.

Despite it all, including an ignorance of anesthesia and antibiotics tempered with the now considered result of the patient suffering from and/or succumbing to the effects of a surgical operation, surgery was long considered an important art and science. This seeming paradox, in view of the terrifying nature of surgical intervention, its limited technical scope, and its daunting consequences, before the development of modern conditions, is explained by the simple fact that surgical procedures were usually performed only for external difficulties that required an "objective" anatomic diagnosis. Surgeons or followers of the surgical cause saw what needed to be fixed (e.g., abscesses, broken bones, bulging tumors, catarrhal sinuses, etc.) and then attempted to become a learned vocation. Standardized postgraduate surgical education and training programs could be established to help produce a cadre of scientifically knowledgeable practitioners. And in a final sash in an unscientific past, newly established basic surgical research laboratories offered the means of proving or disproving the latest theories in a more rational manner as the times permitted. Conversely, the physician was forced to render "subjective" care for disease processes that were neither visible nor understood. After all, it is a difficult task to treat the symptoms of illnesses such as arthritis, asthma, heart failure, and diabetes, to name but a few, if there is no scientific understanding or "internal" knowledge of what constitutes their basic pathologic and physiologic underpinnings.

With the breakthroughs made in pathologic anatomy and experimental physiology during the 18th and the first part of the 19th centuries, physicians would soon adopt a doctrine that had long been prevalent among surgeons. It was no longer a question of just treating symptoms; the actual pathologic problem could ultimately be understood. Internal disease processes that manifested themselves through difficult-to-treat external signs and symptoms were finally described via physiology-based experimentation or viewed pathologically through the lens of a microscope. Because this reorientation of internal medicine occurred within a relatively short time and was followed by dramatic changes in classification, diagnosis, and treatment of disease, the rapid ascent of mid-19th century "internal" medicine might seem more impressive than the agonizingly slow and steady advance of surgery. In a seeming contradiction of mid-19th century scientific and social reality, medicine appeared as the more progressive branch, with surgery lagging behind. The art and craft of surgery, for all its practical possibilities, would be severely restricted until the discovery of anaesthesia in 1846 and an understanding and acceptance of the need for surgical antisepsis and asepsis in the first two decades of the 19th century. Still, surgeons never needed a diagnostic and pathologic revolution in the manner of the physiologist. The pre-modern era surgeon did care with some technical confidence.

That the practice of surgery was superseded in the 1880s and 1890s by a rapid introduction of startling new technical advances was based on a simple culturist axiom—the four fundamental clinical prerequisites that were required before a surgical operation could ever be considered a truly viable therapeutic procedure had finally been identified and understood: (1) knowledge of human anatomy; (2) a method for controlling hemorrhage and maintaining intraoperative hemostasis; (3) anesthesia to permit the performance of pain-free procedures; and (4) an explanation of the nature of infection along with the elaboration of methods necessary to achieve an aseptic and aseptic operating room environment. The first two prerequisites were essentially solved in the 16th century, but the latter two would not be fully resolved until those ending decades of the 19th century. In turn, the ascent of 20th century scientific surgery would unify the profession and allow what had always been an art and craft to become a learned vocation. Standardized postgraduate surgical education and training programs could be established to help produce a cadre of scientifically knowledgeable practitioners. And in a final sash in an unscientific past, newly established basic surgical research laboratories offered the means of proving or disproving the latest theories in a more rational manner as the times permitted. Conversely, the physician was forced to render "subjective" care for disease processes that were neither visible nor understood. After all, it is a difficult task to treat the symptoms of illnesses such as arthritis, asthma, heart failure, and diabetes, to name but a few, if there is no scientific understanding or "internal" knowledge of what constitutes their basic pathologic and physiologic underpinnings.

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ul, while on high the perched physician/surgeon lectured by reading from an orthodoxy anatomic text. This principle of hands-on education would remain Vesalius' most important and lasting contribution to the teaching of anatomy. Vesalius' Latin text a work scoured for its accessibility to the most well-known physicians and scientists of the day. Latin was the language of the intelligentsia, and the Fabrica became instantly popular, so it was only natural that the next two centuries the work would go through numerous adaptations, editions, and revisions, although always remaining an authoritative anatomic text.

METHOD FOR CONTROLLING HEMORRHAGE

Ambrose Pare's (1510-1590) (Fig. 1-2) position in the evolution of surgery remains of supreme importance. He played a major role in reviving and updating Renaissance surgery and represents the severing of the final link between surgical thought and techniques of the ancients and the push toward more modern eras. From 1536 until just before his death, Pare was either engaged as an army surgeon, accompanying different French armies on their military expeditions, or performing surgery in civilian practice in Paris. Although other surgeons made similar observations about the difficulties and nonsensical aspects of using boiling oil as a means of cauterizing fresh gunshot wounds, Pare's employment of a less irritating elimination of egg yolk, rose oil, and turpentine brought him lasting fame and glory. His ability to articulate such a finding in multiple textbooks, all written in the vernacular, allowed his writings to reach more than just the educated elite. Among Pare's most important corollary observations was that in performing an amputation, it was more efficacious to ligate individual blood vessels than to attempt to control hemorrhage by means of mass ligation of tissue or with hot oclum. Described in his Disc Lireurs de la Cisturage with the Magisniet Instrumen Necessaire (1568), the "purple cuticle" of a blood vessel was doubly ligated and the ligature was allowed to remain undisturbed in situ until, as the result of local suppuration, it was cut and the humbly achieved "win success with patients to God, as noted in his famous motto, "Je le parsay, Dieu le guerit," that is, "I treated him. God cured him."

PATHOPHYSIOLOGIC BASIS OF SURGICAL DISEASES

Although it would be another three centuries before the third desideratum, that of anesthesia, was discovered, much of the scientific understanding concerning efforts to relieve discomfort secondary to surgical operations was based on the 18th century work of England's premier surgical scientist, John Hunter (1728-1793) (Fig. 1-3). Considering one of the most influential surgeons of all time, his endeavors stand out because of the profuseity of his written word and the quality of his research, especially in using experimental animal surgery as a way to understand the pathophysiological basis of surgical diseases. Most impressively, Hunter relied little on the theories of past
ether, and nitrous oxide had been discovered and "laughing gas parties" and "ether frolics" were in vogue, especially in America. Young people were amusing themselves with the pleasant side effects of these compounds as itinerant "professors" of chemistry traveled to hamlets, towns, and cities, lecturing on and demonstrating the exhilarating effects of these new gases. It soon became evident to various physicians and dentists that the "pain-relieving" qualities of ether and nitrous oxide could be applicable to surgical operations and tooth extraction. On October 16, 1846, William T. G. Morton (1819-1868), a Boston dentist, persuaded John Collins Warren (1778-1856), professor of surgery at the Massachusetts General Hospital, to let him administer sulfuric ether to a surgical patient from whom Warren went on to painlessly remove a small, congenital vascular tumor of the neck. After the operation, Warren, greatly impressed with the new discovery, uttered his famous words: "Gentlemen, this is no humbug."

Few medical discoveries have been so readily accepted as inhalation anesthesia. News of the momentous event spread rapidly throughout the United States and Europe: A new era in the history of surgery had begun. Within a few months after the first public demonstration in Boston, ether was used in hospitals throughout the world. Yet, no matter how much it contributed to the relief of pain during surgical operations and decreased the surgeon's angst, the discovery did not immediately further the scope of elective surgery. Such technical triumphs awaited the recognition and acceptance of antisepsis and asepsis. Anesthesia helped make the illusion of surgical cures more seductive, but it could not bring forth the final prerequisite: all-important hygienic reforms.

Still, by the mid-19th century, both doctors and patients were coming to hold surgery in relatively high regard for its pragmatic appeal, technologic virtuosity, and unambiguously measurable results. After all, surgery appeared to some a mystical craft. To be allowed to consensually cut into another human's body, to gaze at the depth of that person's suffering, and to excise the demon of disease seemed an awesome responsibility. Yet, it was this very mysticism, long associated with religious overtones, that so fascinated the public and their own feared but inevitable date with a surgeon's knife. Surgeons had finally begun to view themselves as combining art and nature, essentially assisting nature in its continual process of destruction and rebuilding. This regard for the natural would spring from the eventual, although preternaturally slow, understanding and use of Joseph Lister's (1827-1912) techniques (Fig. 1-4).

ANTISEPSIS, ASEPSIS, AND UNDERSTANDING
THE NATURE OF INFECTION

In many respects, the recognition of antisepsis and asepsis was a more important event in the evolution of surgical history than was the advent of inhalation anesthesia. There was no arguing that the deadening of pain permitted a surgical operation to be conducted in a more efficacious manner. Haste was no longer of prime concern.
Other and nitrous oxide had been discovered and "laughing gas parties" and "ether frolics" were in vogue, especially in America. Young people were amusing themselves with the pleasant side effects of these compounds as itinerant "professors" of chemistry traveled to hamlets, towns, and cities. Patients of asphyxia, chemists demonstrating the exhilarating effects of these new gases. It soon became evident to various physicians and dentists that the "painless" or "laughing" gas could be applicable to surgical operations and tooth extraction. On October 16, 1846, William T. G. Morton (1819-1868), a Boston dentist, described to the Massachusetts General Hospital, to let him administer sulfuric ether to a surgical patient. From then on, Warran went on to painlessly remove a small, congenital vascular tumor of the neck. After the operation, Warren, greatly impressed with the new discovery, uttered his famous words: "Gentlemen, this is no humbug."

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Still, by the mid-19th century, both doctors and patients were coming to hold surgery in relatively high regard as its-pragmatic appeal, technician virtuosity, and unambiguously measurable results. After all, surgery appeared to be something of a mystery. To be allowed to occasionally cut into another body that had to be kept at the depth of another's suffering, and to excise the demon of disease seemed an awesome responsibility. Yet, it was this very mystery, less connected with religious overtones, that fascinated the public and their own feared but inevitable date with a surgeon's scalpel. Surgeons began to go beyond the technological and surgically assisting nature in its continual process of destruction and rebuilding. This regard for the surgical analgesia that would spring from the eventual, although prematurely disappearing and use of Joseph Lister's (1827-1912) techniques (Fig. 1-4).

**Antisepsis, Asepsis, and Understanding the Nature of Infection**

In many respects, the recognition of antisepsis and asepsis was a most profound change in the evolution of surgical practice than was the advent of inhalation anesthesia. There was no arguing that the deadening of pain permitted a surgical operation to be conducted in a more efficacious manner. Hence was no longer of prime concern.

However, if anesthesia had never been conceived, a surgical procedure could still be performed, albeit with much difficulty. Such was not the case with Lister. Without antisepsis and asepsis, major surgical operations more than likely ended in death rather than just pain. Clearly, surgery needed both antisepsis and asepsis, but in terms of overall importance, antisepsis proved of greater singular impact.

In the long evolution of world surgery, the contributions of several individuals stand out as being preeminent. Lister, an English surgeon, can be placed on such a select list because of his contribution to surgery. He was the first to introduce antisepsic and antiseptic techniques into hospital surgery. His work was to reshape the practice of surgery. His invention of antisepsic and antiseptic techniques was to become the cornerstone of modern surgery. It was evident to Lister that a method of destroying bacteria by excessive heat could not be applied to a surgical patient. He turned, instead, to chemical antiseptics and after experimenting with zinc chloride and the sulfides, decided on carbolic acid. By 1865, Lister was using pure carbolic acid into wounds and on dressings. He would eventually make numerous modifications in the technique of the dressings, the manner of applying and retaining them, and the choice of antiseptic solutions of varying concentrations. Although the carbolic acid spray remains the best remembered of his many contributions, it was one of the most neglected and ignored. Other germicidal substances. Lister not only used carbolic acid in the wound and on dressings but also went so far as to spray it in the atmosphere around the operative field and table.

He did not emphasize hand scrubbing but merely dipped his fingers into a solution of phenol and corrosive sublimate. Lister was indeed convinced that scrubbing created crevices in the palms of the hands where bacteria would proliferate. A second important advance by Lister was in the development of sterile absorbable suture. He believed that much of the deep suppuration found in wounds was created by previously contaminated silk ligatures. Lister evaluated a carbolic coated suture that was better than any previously produced. He was able to cut short the ends of the ligature, thereby closing the wound tightly, and eliminate the necessity of bringing the ends of the suture out through the incision, a surgical practice that had persisted since the days of Paré.

The acceptance of Listerian was an uneven and distinctly slow process. There were many reasons for this. First, the various procedural changes Lister made during the evolution of his methodology created confusion. Second, Listerism, as a technical exercise, was complicated by the use of carbolic acid, an unpleasant and time-consuming nuisance. In the 1850s, Lister developed antiseptics. If antiseptics in surgery had proved abject failures, with many leading surgeons unable to replicate Lister's generally good results. Finally, and most important, the acceptance of Listerism depended entirely on an understanding and ultimate recognition of the veracity of the germ theory, a hypothesis that many practical-minded surgeons were loath to accept.

As a professional group, German-speaking surgeons were the first to grasp the importance of bacteriology and the germ theory. Among the earliest to expand on Lister's message of antisepsis, with his spray being discarded in favor of boiling and use of the autoclave. The availability of heat sterilization engendered sterile sponges, drapes, instruments, and sutures. Similarly, the use of face masks, gloves, hats, and operating gowns naturally evolved. By the mid-1890s, less clumsy aseptic techniques had found their way into most European surgical amphitheaters and were coming near to the standard accepted by American surgeons. Any lingering doubts about the validity and significance of the momentous concepts Lister had put forth were eliminated on the battlefields of World War I. There, the importance of sterilization and antisepsis became invaluable an lesson for scalpel bearers, whereas the exigencies of the battlefield helped bring about the development and equitable standing of surgery and surgeons within the worldwide medical community.

**X-Rays**

Especially prominent among other late 19th century discoveries that had an enormous impact on the evolution of surgery was research into the nature of x-rays. As early as 1895, Wilhelm Roentgen (1845-1923), leading to his 1895 elucidation of x-rays. Having grown interested in the phosphorescence from luminous bodies, he was aware of the phenomenon in a clear vision of the importance of x-rays and their ability to pass through bone to reveal the interior of a body. He had the chance to observe x-rays passing through bone while working in a laboratory. He was struck by the effect of sending a current through a microscope and looking through the glass at the moving shadow of the x-rays. He realized that this observation was a significant discovery and that x-rays could be used to visualize internal structures of the body. This discovery opened up a completely new field of medical imaging, allowing doctors to visualize internal structures without invasive procedures. It was a groundbreaking discovery that would revolutionize medicine and change the way surgeries were performed.
ued after the current was turned off. He found that the screen had been painted with a phosphorescent substance. Proceeding with full experimental vigor, Roentgen soon realized that there were “invisible” rays capable of passing through solid objects made of wood, metal, and other materials. Most significant, these rays also penetrated the soft parts of the body in such a manner that the more dense bones of his hand were able to be revealed on a specially treated photographic plate. In a short time, numerous applications were developed as surgeons rapidly applied the new discovery to the diagnosis and location of fractures and dislocations and the removal of foreign bodies.

TURN OF THE 20TH CENTURY

By the late 1890s, the interactions of political, scientific, socioeconomic, and technical factors set the stage for what would become a spectacular showcasing of surgery’s newfound prestige and accomplishments. Surgeons were finally wearing antiseptic-looking white coats. Patients and tables were draped in white, and basins for bathing instruments in chloride solution abounded. Suddenly all was clean and tidy, with the conduct of the surgical operation no longer a haphazard affair. This reformation would be successful not because surgeons had fundamentally changed but because medicine and its relationship to scientific inquiry had been irrevocably altered. Sectarianism and quackery, the consequences of earlier medical dogmatism, would no longer be tenable within the confines of scientific truth.

With all four fundamental clinical prerequisites in place by the turn of the century and highlighted with the emerging clinical triumphs of various English surgeons including Robert Tait (1845-1899), William Macewen (1848-1924), and Frederick Treves (1853-1923); German-speaking surgeons, among whom were Theodor Billroth (1829-1894) (Fig. 1-5), Theodor Kocher (1841-1917) (Fig. 1-6), Friedrich Trendelenburg (1844-1924), and Johann von Mikulicz-Radecki (1850-1905); French surgeons, including Jules Peitn (1830-1898), Just Lucas-Championnère (1843-1913), and Marin-Theodore Tuffier (1857-1929); the Italians, most notably Eduardo Bassini (1844-1924) and Antonio Ceci (1852-1920); and several American surgeons, exemplified by William Williams Keen (1837-1932), Nicholas Senn (1844-1908), and John Benjamin Murphy (1857-1916), scalpel wielders had essentially explored all cavities of the human body. Nonetheless, surgeons retained a lingering sense of professional and social discomfort and continued to be pejoratively described by nouveau “scientific” physicians as “nonthinkers” who worked in little more than an inferior and crude manual craft.

It was becoming increasingly evident that research models, theoretical concepts, and valid clinical applications would be necessary to demonstrate the scientific basis of surgery to a wary public. The effort to devise new operative methods called for an even greater reliance on experimental surgery and an absolute encouragement of it by all concerned parties. Most importantly, a scientific basis for therapeutic surgical recommendations—consisting of empirical data, collected and analyzed according to nationally and internationally accepted rules and set apart from individual authoritative assumptions—would have to be developed. In contrast with previously unexplainable doctrines, scientific research would triumph as the final arbiter between valid and invalid surgical therapies.
In turn, surgeons had no choice but to ally society's fear of the surgical unknown by presenting surgery as an accepted part of a newly established medical armamen-
tization. This would not be an easy task. The immediate consequences of surgical operations, such as discomfort and associated complications, were often of more concern to patients than was the positive knowledge that an operation could eliminate potentially devastating disease processes. Accordingly, the most consequential achieve-
ment by surgeons during the early 20th century was assur-
ing the social acceptability of surgery as a legitimate scientific endeavor and the surgical operation as a ther-
apeutic necessity.

ASCENT OF SCIENTIFIC SURGERY

William Stewart Halsted (1852-1922) (Fig. 1-7), more than any other surgeon, set the scientific tone for this most important period in surgical history. He moved surgery from the melodramatics of the 19th century operating theater to the starkness and sterility of the modern operat-
ing room, concomitantly with the privacy and sobriety of the research laboratory. As professor of surgery at the newly opened Johns Hopkins Hospital and School of Medicine, Halsted proved a complex personality, but the impact of this aloof and reclusive man would become wide-
spread. He introduced a "new" surgery, showing that research based on anatomic, pathologic, and physiologic principles and employing animal experimentation made it possible to develop sophisticated operative procedures and perform them clinically with outstanding results.

Halsted proved, to an often leery profession and public, that an unambiguously sequence could be constructed from the laboratory to the operating room. More importantly, for surgery's own self-respect, he demonstrated during this turn-of-the-century period that surgeons performed in a surgical operating room. Most important, for surgery's own self-respect, he demonstrated during this turn-of-the-century period that depart-
ments of surgery could command a faculty whose stature was equal in importance and prestige to that of other medical departments. This was a great coup for surgery, such as anatomy, bacteriology, biochemistry, internal medicine, pathology, and physiology.

As a single individual, Halsted developed and dissimi-
nated a different system of surgery so characteristic that it was referred to as a school of surgery. More to the point, Halsted's methods revolutionized the world of surgery and earned his work the epithet halstedian principles, which remains a widely acknowledged and accepted scientific impetus. Halsted subordinated technical brilliance and speed of dissection to a meticulous and safe, albeit sometimes slow, performance. As a direct result, Halsted's effort did much to train a self-scrutinizing transformation from therapeutic subservience to clinical necessity.

Despite his demeanor as a professional recluse, Halsted's clinical and research achievements were over-
whelming in number and scope. His residency systems of training were based on the idea of an internship in the traditional sense of the term, but it was unique in its primary purpose. Above all other concerns, Halsted desired to establish a school of surgeons that would pervade throughout the surgical world the principles and attributes he considered sound and proper. His aim was to train able surgical teach-
ers, not merely competent operating surgeons. There is little doubt that Halsted achieved his stated goal of pro-
ducing "not only surgeons but surgeons of the highest type, men who will stimulate the first youth of our country to study surgery and to devote their energies and their lives to raising the standards of surgical science." So funda-
mental were his contributions that without them, surgery might never have fully developed and could have remained mired in a quasi-professional state.

The heroic and dangerous nature of surgery seemed appealing to less scientifically sophisticated times. But now, surgeons were courted for personal attributes beyond their unmitigated technical boldness. A trend toward hospital-based surgery was increasingly evident, owing in equal parts to new, technically demanding oper-
ations and to modern hospital physical structures in which surgeons could work more effectively. The increasing complexity and effectiveness of anesthetic surgery, the diagnostic necessity and value of a surgical operating room, the convenience of 24-hour nursing, and the availability of capable surgical residents living within a hospital were making the hospital operating room the most plausible and convenient place for a surgical operation to be completed.

It was obvious to both hospital superintendents and the whole of medicine that acute-care institutions were becoming a necessity more for the surgeon than for the physician. As a consequence, many great hospitals of hos-
pitals went to great lengths to supply their surgical staffs

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tionally and internationally accepted rules and set apart from individual authoritative assumptions—would have to be developed. In contrast with previously unexplainable doctrines, scientific research would triumph as the final arbiter between valid and invalid surgical therapies.
with the finest facilities in which to complete operations. For centuries, surgical operations had been performed under the illumination of sunlight and/or candles. Now, however, electric lights installed in operating rooms offered a far more reliable and unwavering source of illumination. Surgery became a more proficient craft because surgical operations could be completed on stormy summer mornings as well as wet winter afternoons.

INTERNATIONALIZATION, SURGICAL SOCIETIES, AND JOURNALS

As the sophistication of surgery grew, internationalization became one of its underlying themes, with surgeons crossing the great oceans to visit and learn from one another. Halsted and Hermann Kütner (1870-1932), director of the surgical clinic in Breslau, Germany (now known as Wroclaw and located in southwestern Poland), instituted the first known official exchange of surgical residents in 1914. This experiment in surgical education was meant to underscore the true international spirit that had engulfed surgery. Halsted firmly believed that young surgeons achieved greater clinical maturity by observing the practice of surgery in other countries as well as in their own.

An inevitable formation of national and international surgical societies and the emergence and development of periodicals devoted to surgical subjects proved important adjuncts to the professionalization process of surgery. For the most part, professional societies began as a method of providing mutual improvement via personal interaction with surgical peers and the publication of presented papers. Unlike surgeons of earlier centuries, who were known to closely guard "trade secrets," members of these new organizations were emphatic about publishing transactions of their meetings. In this way, not only would their surgical peers read of their clinical accomplishments but also a written record was established to be circulated throughout the world of medicine.

The first of these surgical societies was the Académie Royale de Chirurgie in Paris, with its Mémoires appearing sporadically from 1743 through 1838. Of 19th century associations, the most prominent published proceedings were the Mémoires and Bulletins of the Société de Chirurgie of Paris (1847), the Verhandlungen of the Deutsche Gesellschaft für Chirurgie (1872), and the Transactions of the American Surgical Association (1883). No surgical association that published professional reports existed in 19th century Great Britain, and the Royal Colleges of Surgeons of England, Ireland, and Scotland never undertook such projects. Although textbooks, monographs, and treatises had always been the mainstay of medical writing, the introduction of monthly journals, including August Richter's (1742-1812) Chirurgische Bibliothek (1771), Joseph Malgaigne's (1806-1865) Journal de Chirurgie (1843), Bernard Langenbeck's (1810-1887) Archiv für Klinische Chirurgie (1860), and Lewis Pilcher's (1844-1917) Annals of Surgery (1885), had a tremendous impact on the updating and continuing education of surgeons.

WORLD WAR I

Austria-Hungary and Germany continued as the dominating forces in world surgery until World War I. However, results of the conflict proved disastrous to the central powers (Austria-Hungary, Bulgaria, Germany, and the Ottoman Empire) and especially German-speaking surgeons. Europe took on a new social and political look, with the demise of Germany's status as the world leader in surgery a sad but foregone conclusion. As with most armed conflicts, because of the massive human toll, especially battlefield injuries, tremendous strides were made in multiple areas of surgery. Undoubtedly, the greatest surgical achievement was in the treatment of wound infection. Trench warfare in soil contaminated by decades of cultivation and animal manure made every wounded soldier a potential carrier of any number of pathogenic bacilli. On the battlefield, sepsis was inevitable. Most attempts to maintain aseptic technique proved inadequate, but the treatment of infected wounds by antisepsis was becoming a pragmatic reality.

Surgeons experimented with numerous antisepsic solutions and various types of surgical dressing. A principle of wound treatment applied by means of débridement and irrigation eventually evolved. Henry Dakin (1880-1952), an English chemist, and Alexis Carrel (1873-1944) (Fig. 1-8), the Nobel prize-winning French American surgeon, were the principal protagonists in the development of this extensive system of wound management. In addition to successes with wound sterility, surgical advances were made in the use of x-rays in the diagnosis of battlefield injuries, and remarkable operative ingenuity was evident in reconstructive facial surgery and the treatment of fractures resulting from gunshot wounds.

![Figure 1-8. Alexis Carrel (1873-1944).](image-url)
with the finest facilities in which to complete operations. For centuries, such operations had been performed under the illumination of sunlight and/or candles. Now, however, electric lights installed in operating rooms offered a far more effective and unobstructed source of illumination. Surgery became a more proficient craft because surgical operations could be completed on stormy summer mornings as well as wet winter afternoons.

INTERNATIONALIZATION, SURGICAL SOCIETIES, AND JOURNALS

As the sophistication of surgery grew, internationalization became one of its underlying themes, with surgeons crossing the great oceans to visit and learn from one another. Jakob and Hermann Küber (1870-1932), director of the surgical clinic in Breslau, Germany (now known as Wroclaw and located in southwestern Poland), instituted the first annual meeting of surgical residents in 1914. This experiment in surgical education was meant to underscore the true international spirit that had engendered surgery. Nationally, it was thus believed that young surgeons achieved greater clinical maturity by observing the practice of surgery in other countries as well as in their own.

An increasing number of international surgical societies and the emergence and development of periodicals devoted to surgical subjects proved important developments in the rapidly changing nature of surgery. For the most part, professional societies began as a method of providing mutual improvement via personal interaction with one another and the publication of presented papers. Unlike surgeons of earlier centuries, who were known to closely guard trade secrets, members of these new organizations were enthusiastic about publishing their transactions of their meetings. In this way, not only would their surgical peers read of their clinical accomplishments but also a written record was established to be preserved throughout the world of medicine.

The first of these surgical societies was the Académie Royale de Chirurgie in Paris, with its Mémoires appearing sporadically from 1715 through 1838. Of 19th century associations, the most prominent published proceedings were the Mémoires and Bulletin of the Société de Chirurgie of Paris (1847), the Verhandlungen of the Deutsche Gesellschaft für Chirurgie (1872), and the Transactions of the American Surgical Association (1885). No surgical association that published professional reports existed in 19th century Great Britain, and the Royal College of Surgeons of England, Ireland, and Scotland never undertook such projects. Although textbooks, monographs, and treatises had always been the mainstay of medical writing, the introduction of monthly journals, including August Richter’s (1742-1812) Chirurgische Bibliothek (1771), Joseph Malgaigne’s (1806-1865) Journal de Chirurgie (1843), Richard Langenbeck’s (1810-1887) Archives für Klinische Chirurgie (1860), and Louis-Pilcher’s (1844-1917) Annals of Surgery (1885), had a tremendous impact on the updating and continuing education of surgeons.

AMERICAN COLLEGE OF SURGEONS

For American surgeons, the years just before World War I were years of aggressive coalescence into various social and educational organizations. The most important and influ-
ential of these was the American College of Surgeons founded by Franklin Martin (1857-1945), a Chicago-based gynecologist, in 1913. Patterned after the Royal College of Surgeons in London and the Society of Fellows of the American College of Surgeons established professional, ethical, and moral standards for every graduate in medicine who had undergone specialty training considered a "Fellow of the American College of Surgeons (FACS)" on its members. From the outset, its primary aim was the continuing education of surgical practitioners. Accordingly, the requirements for fellowship were always related to the educational opportunities of the period. In 1914, an applicant had to be a licensed graduate of medicine, receive the backing of three fellows, and be endorsed by his local credentials committee.

In view of the stipulations and recommendations, many prospective trainees either ignored or, not viewed the American College of Surgeons as an elitist organization. With an obvious "blackball" system built into the membership requirements, there was a difficult-to-delay belief that many surgeons, who were immigrants, females, or members of particular religious and racial minorities, were granted fellowships sparingly. Such inherent biases, in addition to questionable accusations of fee-splitting along with unfiltered contempt of competing surgeons’ business practices, made the use of essays in the diagnosis of battlefield injuries, and remarkable operative ingenuity was evident in reconstructive facial surgery during treatment of fractures resulting from gunshot wounds.
hospital positions, the ability of the few practicing female physicians to specialize in surgery seemed an impossibility. Consequently, women surgeons were forced to utilize different career strategies than men to have more divergent goals of personal success to achieve professional satisfaction. Despite these difficulties and through the determination and aid of several enlightened male surgeons, most notably William Byford (1817-1890) of Chicago and William Keen of Philadelphia, a small cadre of female surgeons did exist in late 19th century America. Mary Dixon Jones (1828-1908), Emmeline Horton Cleveland (1829-1878), Mary Harris Thompson (1829-1895), Anna Elizabeth Broomall (1847-1931), and Marie Mergler (1851-1901) would act as a nidus toward greater equality of the genders in 20th century surgery.

AFRICAN AMERICAN SURGEONS

There is little disputing the fact that both gender and racial bias have affected the evolution of surgery. Every aspect of society is affected by such discrimination, and African Americans, like women, were innocent victims of injustices that forced them into never-ending struggles to attain competency in surgery. As early as 1868, a department of surgery was established at Howard University. However, the first three chairmen were all white Anglo-Saxon Protestants. Not until Austin Curtis was appointed professor of surgery in 1928 did the department have its first African American head. Like all black physicians of his era, he was forced to train at “Negro” hospitals, in Curtis’ case Provident Hospital in Chicago, where he came under the tutelage of Daniel Hale Williams (1858-1931), the most influential and highly regarded of early African American surgeons. In 1897, Williams received considerable notoriety when he reported a successful suturing of the pericardium for a stab wound of the heart.

With little likelihood of obtaining membership in the American Medical Association or its related societies, in 1895, African American physicians joined together to form the National Medical Association. Black surgeons identified an even more specific need when the Surgical Section of the National Medical Association was opened in 1906. These National Medical Association surgical clinics, which preceded the Clinical Congress of Surgeons of North America, the forerunner to the annual congress of the American College of Surgeons, by almost half a decade, represented the earliest instances of organized “show-me” surgical education in the United States.

Admittance to surgical societies and attainment of specialty certification were important social and psychological accomplishments for early African American surgeons. When Daniel Williams was named a Fellow of the American College of Surgeons in 1913, the news spread rapidly throughout the African American surgical community. Still, African American surgeons’ fellowship applications were often acted on rather slowly, which suggested that denials based on race were clandestinely conducted throughout much of the country. As late as the mid 1940s, Charles Drew (1904-1950) (Fig. 1-9), chairman of the department of surgery at Howard University School of Medicine, acknowledged that he refused to accept membership in the American College of Surgeons because this “nationally representative” surgical society had, in his opinion, not yet begun to freely accept capable and well-qualified African American surgeons.

MODERN ERA

Despite World War I’s aftermath of a global economic depression, the 1920s and 1930s signaled the ascent of American surgery to its current position of international leadership. Highlighted by educational reforms in its medical schools, Halsted’s redefinition of surgical residency programs, and the growth of surgical specialties, the stage was set for the blossoming of scientific surgery. Basic surgical research became an established reality as George Crile (1864-1943), Alfred Blalock (1899-1964) (Fig. 1-10), Dallas Phemister (1882-1951), and Charles Huggins (1901-1997) became world-renowned “surgeon-scientists.”

Much as the ascendency of the surgeon-scientist brought about changes in the way in which the public and the profession viewed surgical research, the introduction of increasingly sophisticated technologies had an enormous impact on the practice of surgery. Throughout the evolution of surgery, the practice of surgery—the art, the craft, and finally, the science of working with one’s hands—had been largely defined by its tools. From crude flint instruments of ancient peoples, through the simple tonsillektomes and lithotrites of the 19th century, up to the increasingly complex surgical instruments developed in
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Surgical techniques would, of course, become more sophisticated with the passage of time, but by the conclusion of World War II, essentially all organs and areas of the body had been fully explored. Essentially, within a short half-century of the domain of surgery had become so well established that the profession’s foundation of basic operative procedures was already completed. As a consequence, there were few surgical technical mysteries left. What surgery now needed to sustain its continued growth was the ability to diagnose surgical diseases at earlier stages, to locate malignant growths while they remained small, and to have more effective postoperative treatment so that patients could survive ever more technically complex operations. Such thinking was exemplified by the introduction in 1924 of cholecystography by Alfred Blalock (1899-1954) and Warren Cole (1898-1959). In this case, an emerging anatomic science introduced new possibilities into surgical practice that were not necessarily related solely to improvements in technique. To the surgeon, the discovery and application of cholecystography proved most important not only because it brought about more accurate diagnoses of cholecystitis but also because it created an influx of surgical patients with few had previously existed. If surgery was to grow, then large numbers of individuals with surgical diseases were needed.
way surgeons viewed themselves and their interactions with the society in which they lived and worked.

LAST HALF OF THE 20TH CENTURY

The decades of economic expansion after World War II had a dramatic impact on surgery’s scale, particularly in the United States. It was as if being victorious in battle permitted medicine to become big business overnight, with the single-minded pursuit of health care rapidly transformed into society’s largest growth industry. Spacious hospital complexes were built that not only represented the scientific advancement of the healing arts but also vividly demonstrated the strength of America’s postwar socioeconomic boom. Society was willing to give surgical science unprecedented recognition as a prized national asset.

The overwhelming impact of World War II on surgery was the sudden expansion of the profession and the beginnings of an extensive distribution of surgeons throughout the country. Many of these individuals, newly baptized to the rigors of technically complex trauma operations, became leaders in the construction and improvement of hospitals, multispecialty clinics, and surgical facilities in their hometowns. Large urban and community hospitals established surgical education and training programs, finding it a relatively easy matter to attract interns and residents. For the first time, residency programs in general surgery were rivaled in growth and educational sophistication by those in all the special fields of surgery. These changes served as fodder for further increases in the number of students entering surgery. Not only would surgeons command the highest salaries, but society was also enamored of the drama of the operating room. Television series, movies, novels, and the more-than-occasional live performance of a heart operation on network broadcast beckoned the lay individual.

Despite lay approval, success and acceptability in the biomedical sciences are sometimes difficult to determine, but one measure of both in recent times has been the awarding of the Nobel Prize in medicine and physiology. Society’s continued approbation of surgery’s accomplishments is seen in the naming of nine surgeons as Nobel laureates (Table 1-1).

CARDIAC SURGERY AND ORGAN TRANSPLANTATION

Two clinical developments truly epitomized the magnitude of post-World War II surgery and concurrently fascinated the public: the maturation of cardiac surgery as a “new” surgical specialty and the emergence of organ transplantation. Together they would stand as signposts along the new surgical highway. Fascination with the heart goes far beyond that of clinical medicine. From the historical perspective of art, customs, literature, philosophy, religion, and science, the heart has represented the seat of the soul and the wellspring of life itself. Such reverence also meant that this noble organ was long considered a surgical untouchable. Whereas the late 19th and 20th centuries witnessed a steady march of surgical triumphs for opening successive cavities of the body, the final achievement awaited the perfection of methods for surgical operations in the thoracic space.

Such a scientific and technologic accomplishment can be traced back to the repair of cardiac stab wounds by direct suture and the earliest attempts at fixing faulty heart valves. As triumphant as Luther Hill’s (1862-1946) first known successful suture of a wound that penetrated a cardiac chamber was in 1902, it would not be until the 1940s that the development of safe intrapleural surgery could be counted on as something other than an occasional event. During World War II, Dwight Harken (1910-1993) gained extensive battlefield experience in removing bullets and shrapnel in or in relation to the heart and great vessels without a single fatality. Building on his wartime experience, Harken and other pioneering surgeons, including Charles Bailey (1910-1993) of Philadelphia and Russell Brock (1903-1980) of London, proceeded to expand intracardiac surgery by developing operations for the relief of mitral valve stenosis. The procedure was

<table>
<thead>
<tr>
<th>Surgeon (Dates)</th>
<th>Country</th>
<th>Field (Year of Award)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theodor Kocher (1841-1917)</td>
<td>Switzerland</td>
<td>Thyroid disease (1909)</td>
</tr>
<tr>
<td>Alvar Gullstrand (1862-1930)</td>
<td>Sweden</td>
<td>Ocular dioptics (1911)</td>
</tr>
<tr>
<td>Alexis Carrel (1873-1944)</td>
<td>France, United States</td>
<td>Vascular surgery (1912)</td>
</tr>
<tr>
<td>Robert Bárány (1876-1936)</td>
<td>Austria</td>
<td>Vestibular disease (1914)</td>
</tr>
<tr>
<td>Frederic Banting (1891-1941)</td>
<td>Canada</td>
<td>Insulin (1922)</td>
</tr>
<tr>
<td>Walter Hess (1881-1973)</td>
<td>Switzerland</td>
<td>Midbrain physiology (1949)</td>
</tr>
<tr>
<td>Werner Forssmann (1904-1979)</td>
<td>Germany</td>
<td>Cardiac catheterization (1956)</td>
</tr>
</tbody>
</table>
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Since time immemorial, the focus of surgery was mostly on excision and repair. However, beginning in the late 20th century, the opposite end of the surgical spectrum—reconstruction and transplantation—became reality. Nineteenth century experience had shown that skin and bone tissues could be "autotransplanted" from one site to another in the same patient. It would take the horticultural and medicinal advances of World War II to decisively advance skin transplants and fundamentally change the concept of surgery as a method of reconstruction. With Harold Gillies (1882-1960) of England and Americana's Vilray Blair establishing military-based "plastic surgery" units to deal with combat injuries, a turning point in the way in which society viewed surgery's raison d'être occurred. Now, surgery could enhance nature's healing powers but they could also dramatically alter what had previously been little more than one of the physician's reconstructive modalities, for example, Hippocrates (460-399 B.C.) described a method of membranoplasty in 1692. John Staint Davis (1872-1946) of Baltimore popularized a manner of splitting skin grafts and later wrote the first comprehensive textbook, *Plastic Surgery: Its Principles and Practice* (1919). Immediately after the war, Blair would go on to establish the first separate plastic surgery service in a civilian institution at Barnes Hospital in St. Louis. Vladimir Filatov (1875-1956) of Odessa, Russia, used a tubed pedicle flap in 1916, and, in the following year, Gillies introduced a similar technique. What about the replacement of damaged or diseased organs? After all, even in mid-century, the very thought of reconstructing a transplanted heart or a diseased kidney, or even a pancreas of unhealthy body parts was regarded as scientific fantasy. At the beginning of the 20th century, Alexis Carrel developed revolutionary new suturing techniques that allowed the smallest of blood vessels to be reconstructed. Using his surgical skill on experimental animals, Carrel began "to transplant" kidneys, hearts, and spleens. Technically, he removed the organ, then sewed the transplanted organ back to the body. Without the unknown biologic process always led to the rejection of the transplanted organ and death of the animal. By mid-century, medical researchers had begun to clarify the presence of underlying "defensive" immune reactions and the necessity of creating "immunosuppression" as a method to allow the host to "accept" the foreign transplant.

Using high-powered immunosuppressant drugs and other modern modalities, kidney transplantation soon became a reality, and it was only one of many organs and even whole hands being replaced.

**POLITICAL AND SOCIOECONOMIC INFLUENCES**

Despite the 1950s and 1960s witnessing some of the most magnificent advances in the history of surgery, by the 1970s, political and socioeconomic influences were starting to overshadow many of the clinical triumphs. It was the beginning of a schizophrenic existence for surgeons: Complex and dynamic challenges of surgery were completed to innumerable accolades, and simultaneously, the public criticism of the economics of medicine, in particular high-priced surgical treatment, portrayed the scalpel holder as an acquisitive, financially driven, selfish individual. This was in stark contrast to the relatively selfless and sanctioned image of the surgeon before the growth of specialty work and the introduction of government involvement in health care delivery.

Although they are philosophically inconsistent, the catastrophic and the political aspect of surgery that make surgeons heroes from one perspective and symbols of corruption, mendacity, and greed from the opposite point
of view are the very reasons why society demands so much of its surgeons. There is the precise and definitive nature of surgical intervention, the expectation of success that surrounds an operation, the short time frame in which outcomes are realized, the high income levels of most surgeons, and the almost insatiable inquisitiveness of lay individuals concerning all aspects of the act of consensually cutting into another human's flesh. These phenomena, ever more sensitized in an age of mass media and instantaneous telecommunication, make the surgeon seem more accountable than his or her medical colleague and, simultaneously, symbolic of the best and the worst in medicine. In ways previously unimaginable, this vast social transformation of surgery controls the fate of the individual practitioner in the present era to a much greater extent than surgeons as a collective force are able to control it by their attempts to direct their own profession.

20TH CENTURY SURGICAL HIGHLIGHTS

Among the difficulties in studying 20th century surgery is the abundance of famous names and important written contributions. So much so that it becomes a difficult and invidious task to attempt any rational selection of representative personalities along with their significant journal or book-length writings. Although many justly famous names might be missing, the following description of surgical advances is intended to chronologically highlight some of the stunning clinical achievements of the past century.

In 1900, the German surgeon Hermann Pfannenstiel (1862-1909) described his technique for a suprapubic surgical incision. That same year, William Mayo (1861-1939) presented his results concerning partial gastrectomy before the American Surgical Association. The treatment of breast cancer was radically altered when George Beatson (1848-1933), professor of surgery in Glasgow, Scotland, proposed oophorectomy and the administration of thyroid extract as a possible cure (1901). John Finney (1863-1942) of The Johns Hopkins Hospital authored a paper on a new method of gastroduodenostomy, or widened pyloroplasty (1903). In Germany, Fedor Krause (1856-1937) was writing about total cystectomy and bilateral ureterosigmoidostomy. In 1905, Hugh Hampton Young (1870-1945) of Baltimore was presenting early studies of his radical prostatectomy for carcinoma. William Handley (1872-1962) was surgeon to the Middlesex Hospital in London when he authored Cancer of the Breast and its Treatment (1906). In that work, he advanced the theory that in breast cancer metastasis is due to extension along lymphatic vessels and not to dissemination via the bloodstream. That same year, José Goyanes (1876-1964) of Madrid used vein grafts to restore arterial flow. William Miles (1869-1947) of England first wrote about his operation of abdominoperineal resection in 1908, the same year that Friedrich Trendelenburg (1844-1924) attempted pulmonary embolectomy. Three years later, Martin Kirschner (1879-1942) of Germany described a wire for skeletal traction and for stabilization of bone fragments or joint immobilization. Donald Balfour (1882-1963) of the Mayo Clinic provided the initial account of his important operation for resection of the sigmoid colon, as did William Mayo for his radical operation for carcinoma of the rectum in 1910.

In 1911, Fred Albee (1876-1945) of New York City began to employ living bone grafts as internal splints. Wilhelm Ramstedt (1867-1963), a German surgeon, described a pyloromyotomy (1912) at the same time that Pierre Frelac (1870-1946) was reporting a similar operation. In 1913, Henry Janeway (1873-1921) of New York City developed a technique for gastrostomy in which he wrapped the anterior wall of the stomach around a catheter and sutured it in place, establishing a permanent fistula. Hans Finsterer (1877-1955), professor of surgery in Vienna, improved on Franz von Hofmeister's (1867-1926) description of a partial gastrectomy with closure of a portion of the lesser curvature and retrocolic anastomosis of the remainder of the stomach to the jejunum (1918). Thomas Dunhill (1876-1957) of London was a pioneer in thyroid surgery, especially in his operation for exophthalmic goiter (1919). William Galie (1882-1959) of Canada used sutures fashioned from the fascia lata in herniorrhaphy (1923). Barney Brooks (1884-1952), professor of surgery at Vanderbilt University in Nashville, Tennessee, initially introduced clinical angiography and femoral arteriography in 1924. Five years later, Reynaldo dos Santos (1880-1970), a Portuguese urologist, reported the first translumbar aortogram. Cecil Joll (1885-1945), professor of surgery in London, fully described the treatment of thyrotoxicosis by means of a subtotal thyroidectomy in the 1930s.

In 1931, George Cheadle (1865-1951), professor of surgery in London, and Max Cutler (1899-1984), a surgeon from New York City, published their important treatise Tumours of the Breast. In that same year, Cutler detailed his systemic use of ovarian hormone in the treatment of chronic mastitis. Around the same time, Ernst Sauerbruch (1875-1951) of Germany completed the first successful surgical intervention for cardiac aneurysm, and his countryman Rudolph Nissen (1896-1981) removed an entire bronchiectatic lung. Geoffrey Keynes (1887-1982) of St. Bartholomew's Hospital in England articulated the basis for the opposition to radical mastectomy and his favoring of radiation treatment in breast cancer (1932). The Irish surgeon Arnold Henry (1886-1962) devised an operative approach for femoral hernia in 1936. Earl Shouldice (1891-1965) of Toronto first began to experiment with a groin hernia repair based on overlapping layers brought together by a continuous wire suture during the 1930s. René Leriche (1879-1955) proposed in 1937 an arteriectomy in arterial thrombosis and, later, a periarterial sympathectomy to improve arterial flow. Leriche also enunciated a syndrome of aortoiliac occlusive disease in 1940. In 1939, Edward Churchill (1895-1972) of the Massachusetts General Hospital performed a segmental pneumonectomy for bronchiectasis. Charles Huggins (1901-1997) (Fig. 1-12), a pioneer in the endocrine therapy for cancer, found that antiandrogenic treatment consisting of orchietomy or the administration of estrogens could produce long-term regression in patients with advanced prostatic cancer. These observations formed the
of view are the very reasons why society demands so much of its surgeons. There is the precise and delicate nature of surgical intervention, the expectation of success that surrounds an operation, the short time frame in which outcomes are realized, the high income levels of most surgeons, and the almost irresistible iniquities of lay individuals considering all aspects of the act of consensually cutting into another human's flesh. These phenomena, even more sensitized in an age of mass media and instantaneous telecommunication, make the surgeon seem more accountable than his or her medical colleague and, simultaneously, symbolic of the best and the worst in medicine. In ways previously unimaginable, this vast social transformation of surgery controls the fate of the individual practitioner in the present era to a much greater degree than as surgeons to a collective era to be able to control by their attempts to direct their own profession.

20TH CENTURY SURGICAL HIGHLIGHTS

Among the difficulties in studying 20th century surgery is the abundance of famous names and important written contributions. So much so that it becomes a difficult and inidious task to attempt any rational selection of representative personalities along with their significant journal or book-length writings. Although many of the names might be missing from the description of surgical advances is intended to chronologically highlight some of the striking clinical achievements of the past century.

In 1900, the German surgeon Hermann Pflüger (1862-1909) described his technique for a vagotomy and pyloroplasty, one of the first steps in the treatment of gastric cancer. The study of gastric cancer was radically altered when William Halsted (1852-1922) introduced his radical approach to the treatment of gastric cancer. Halsted's technique involved the removal of the stomach, spleen, and surrounding lymph nodes, and was adopted by many surgeons in the years following his presentation in 1901. The first surgical procedure to treat gastric cancer was performed by John H. Kellogg (1852-1912) in 1899. Kellogg's procedure involved the removal of the stomach and spleen, and was performed on a 23-year-old woman with gastric cancer. The surgery was successful, and the patient lived for 12 years after the operation.

In 1906, the Mayo Clinic provided the initial account of his operation for treatment of the sigmoid tumor. William Halsted (1852-1922) of New York City began to employ living bone grafts as internal splints. Karlström (1867-1965), a German surgeon, described a pyloroplasty (1912) at the same time that P. F. Fränkel (1870-1940) was reporting a similar operation. In 1913, Henry Janneway (1873-1921) of New York City developed a technique for gastroscopy in which he wrapped the anterior wall of the stomach around a catheter and sutured it in place, establishing a permanent fistula. Hans Pfisterer (1873-1955), professor of surgery in Vienna, improved in 1919 the description of a partial gastrectomy with closure of a portion of the lesser curvature and retrocolic anastomosis of the remainder of the stomach to the jejunum (1918).

Thomas Dunhill (1876-1957) of London was a pioneer in thyroid surgery, especially in his operation for exophthalmic goiter (1939). With his associate Galle (1882-1959), he carried out the first subtotal thyroidectomy (1918). Cecil Joll (1885-1945), professor of surgery in London, further developed the subtotal thyroidectomy by promoting the basis for the development of subtotal thyroidectomies in the 1930s.


In 1955, Edward Church (1884-1965) of the Mayo Clinic performed the first successful resection of an abdominal aortic aneurysm and insertion of a homologous graft. Robert Zollinger (1910-1994) and Edwin Hilton (1918-1970) first described their technique of end-to-end anastomosis in 1955. The following year, Donald Murray (1954-1976) completed the first successful aortic valve homograft. At the same time, John Merrill (1917-1966) was performing the world's first successful homotransplantation of the human kidney between identical twin brothers. Francis D. Moore (1913-2001) (Fig. 1-13) defined objectives of metabolism in surgical patients and in 1959 published his widely quoted book, "The Care of the Surgical Patient." Moore was also a driving force in the field of transplantation and pioneered the technique of using radioactive isotopes to locate abscesses and tumors. In the 1960s, Jonathan E. Rhoads (1907-2002) (Fig. 1-14), in collaboration with colleagues Harry Vars and Stan Dudrick, described the technique of total parenteral nutrition, which has become an important and lifesaving treatment in the management of the critically ill patient who cannot tolerate standard enteral feeding. In 1963, James D. Hardy (1918-2005), at the University of Mississippi, performed the first lung (1963) and heart (1964) transplants in humans.

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Future trends

Throughout most of its evolution, the practice of surgery has been largely defined by its tools and the manual aspects of the craft. The last decades of the 20th century saw unprecedented progress in the development of new
instrumentation and imaging techniques. These refinements have not come without noticeable social and economic cost. Advancement will assuredly continue, because if the study of surgical history offers any lesson, it is that progress can always be expected, at least relative to technology. There will be more sophisticated surgical operations with better results. Eventually, automation may even robotize the surgeon's hand for certain procedures. Still, the surgical sciences will always retain their historical roots as fundamentally a manual-based art and craft.

In many respects, the surgeon's most difficult future challenges are not in the clinical realm but instead in better understanding the socioeconomic forces that affect the practice of surgery and in learning how to effectively manage them. Many splendid schools of surgery now exist in virtually every major industrialized city, but none can lay claim to dominance in all the disciplines that make up surgery. Likewise, the presence of authoritative individual personalities who help guide surgery is more unusual today than in previous times. National aims and socioeconomic status have become overwhelming factors in securing and shepherding the future growth of surgery worldwide. In light of an understanding of the intricacies of surgical history, it seems an unenviable and obviously impossible task to predict what will happen in the future. In 1874, John Erichsen (1818-1896) of London wrote that "the abdomen, chest, and brain will forever be closed to operations by a wise and humane surgeon." A few years later Theodor Billroth remarked, "A surgeon who tries to suture a heart wound deserves to lose the esteem of his colleagues." Obviously, the surgical crystal ball is a cloudy one at best.

To study the fascinating history of our profession, with its manifold personalities and outstanding scientific and social achievements, may not necessarily help us predict the future of surgery. However, it does shed much light on the clinical practices of our own time. To a certain extent, if surgeons in the future wish to be regarded as more than mere technicians, the profession needs to better appreciate the value of its past experiences. Surgery has a distinguished heritage that is in danger of being forgotten. Although the future of the art, craft, and science of surgery remains unknown, it assuredly rests on a glorious past.

**Selected References**


An incisive and provocative address by the Regius Professor of Physic in the University of Cambridge concerning the sometimes strained relations between early medical and surgical practitioners.


Surgeon, hospital architect, originator of the *Index Medicus*, and director of the New York Public Library, Billings' chapter is a comprehensive review of surgery, albeit based on a hagiological theme.


A distinguished medical bibliophile, Bishop's text is best for its description of surgery in the Middle Ages, Renaissance, and 17th and 18th centuries.


An anesthetist at King's College Hospital in London, Cartwright's work is rich in detail and interpretation.


These two works by the highly regarded English surgeon provide overall reviews of the evolution of surgical intervention for intra-abdominal pathology.


A monumentally detailed history of surgery from the beginnings of recorded history to the end of the 16th century. Gurli, a German surgeon, includes innumerable translations from ancient manuscripts. Unfortunately, this work has not been translated into English.


Surgical attendings at Maimonides Hospital in Brooklyn, their numerous chapters contain prefatory information, including a short biography of each surgeon (with portrait) and a reprinted or translated excerpt of each one's most important surgical contribution.


These texts, by the eminent Rochester, New York, surgeon and historian, together provide an in-depth description of the whole of surgery from ancient times to the mid-20th century. Especially valuable are the countless biographies of both famous and near-famous scalpel bearers.


Considered among the most brilliant French surgeons of the 19th century, Malgaigne's history is particularly noteworthy for its study of 15th and 16th century European surgery. This entire work was admirably translated into English by Wallace Hamby, an American neurosurgeon, in *Surgery and Ambroise Paré by J. F. Malgaigne* (Norman, University of Oklahoma Press, 1965).

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