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SABISTON

Textbook of
SURGERY

The Biological Basis of Modern Surgical Practice

19TH
EDITION

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SAUNDERS

SABISTON TEXTBOOK OF SURGERY

19TH EDITION

SABISTON TEXTBOOK OF SURGERY: THE BIOLOGICAL BASIS OF MODERN SURGICAL PRACTICE

19TH EDITION

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with 1645 illustrations

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Library of Congress Cataloging-in-Publication Data or Control Number

Sabiston textbook of surgery : the biological basis of modern surgical practice.—19th ed. / [edited by] Courtney M. Townsend Jr. ... [et al.].

p. ; cm.

Textbook of surgery

Includes bibliographical references and index.

ISBN 978-1-4377-1560-6 (hardcover : alk. paper)

I. Sabiston, David C., 1924-2009. II. Townsend, Courtney M. III. Title: Textbook of surgery.

[DNLM: 1. Surgical Procedures, Operative. 2. General Surgery. 3. Perioperative Care. WO 500] 617—dc23

2011040621

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Content Developmental Manager: Maureen Iannuzzi

Publishing Services Manager: Catherine Jackson

Senior Project Manager: Rachel E. McMullen

Design Direction: Louis Forgione

Printed in Canada

Last digit is the print number: 9 8 7 6 5 4 3 2 1

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TO OUR PATIENTS, who grant us the privilege of practicing our craft; to our students, residents, and colleagues, from whom we learn; and to our wives—Mary, Shannon, Karen, and June—without whose support this would not have been possible.

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FOREWORD

"How many a man has dated a new era in his life from the reading of a book."

Henry David Thoreau (1817-1862)

This 19th edition of *Sabiston Textbook of Surgery*, the fourth edited by Dr. Townsend and his co-editors Drs. Maddox, Beauchamp, and Evers, extends the tradition of textbook excellence and leadership initiated 18 editions ago. The emphasis on clinical relevance and outcomes characteristic of earlier editions has been enhanced by the addition of three new chapters on organ transplantation, two new chapters in the vascular section: "The Aorta" and "Peripheral Arterial Occlusive Disease," and new chapters on the cutting edge topics of tumor immunology and immunotherapy and the "difficult abdominal wall." Other chapters have been embellished by inclusion of the latest information on biomaterials, organ procurement issues, specific gene therapy, biliary tumors, urinary system tumors, and simulation in surgery. Still other content has been revised to increase the focus on evidence-based practice by coverage of comparative effectiveness and patient-specific therapeutics.

The recruitment of more than 50 new authors and co-authors has guaranteed timeliness of the text, ensured full display of state of the art technology, and refreshed the trove of

illustrations which by tradition have amplified and corroborated the text. The authors have also provided over 400 self-assessment questions which will assist the reader in preparing for and successfully achieving recertification.

As was true with the previous edition, ownership of the print text of this edition gives free access to the online product "Expert Consult," which includes full text and art, updates (journal articles selected by the editors and authors and keyed to chapter topics), board review questions, and videos on topics ranging from pleural effusion to hand transplantation and total aortic replacement. Expert Consult makes access to the text and all related material as convenient as the nearest computer.

This 19th edition of Sabiston successfully integrates print and electronic media to provide complete coverage of surgical practice. Full use of all features of this text will increase the reader's practice of evidence-based surgery, facilitate the reader's recertification activities, and promote the reader's acquisition and maintenance of the professional competencies. In short this is truly a text that as foretold by Thoreau will launch each reader on a new era in his or her surgical life.

BASIL A. PRUITT, JR., MD, FACS, FCCM

PREFACE

SURGERY CONTINUES TO EVOLVE as new technology, techniques, and knowledge are incorporated into the care of surgical patients. The 19th edition of the *Sabiston Textbook of Surgery* reflects these exciting changes and new information. We have incorporated eight new chapters and more than 77 new authors to ensure that the most current information is presented. For example, safety is paramount in the care of our surgical patients; our chapter on safety describes the surgeon's roles and responsibilities to ensure safety. We have included a new chapter on management of the difficult abdominal wall, which can be a vexing problem for even the most experienced surgeon. Distant surgery, using robotic and telementoring technology, has become a reality, and minimally invasive techniques are being used in almost all invasive procedures. This new edition has revised and enhanced the current chapters to reflect these changes. Finally, we have extensively updated chapters dealing with basic science

aspects that are important to surgeons and, in many cases, represent scientific advances in which surgeons are leading the charge. This is most evident in the chapters on tumor biology and tumor immunology, transplantation immunology, and the rapidly emerging field of regenerative medicine.

The primary goal of this new edition is to remain the most thorough, useful, readable, and understandable textbook presenting the principles and techniques of surgery. It is designed to be equally useful to students, trainees, and experts in the field. We are committed to maintaining this tradition of excellence, begun in 1936. Surgery, after all, remains a discipline in which the knowledge and skill of a surgeon combine for the welfare of all patients.

COURTNEY M. TOWNSEND, JR., MD

ACKNOWLEDGMENTS

WE WOULD LIKE TO recognize the invaluable contributions of Karen Martin, Steve Schuenke, Eileen Figueroa, and administrator Barbara Petit. Their dedicated professionalism, tenacious efforts, and cheerful cooperation are without parallel. They accomplished whatever was necessary, often on short or immediate deadlines, and were vital for the successful completion of the endeavor.

Our authors, respected authorities in their fields, all busy physicians and surgeons, did an outstanding job in sharing their wealth of knowledge.

We would also like to acknowledge the professionalism of our colleagues at Elsevier: Maureen R. Iannuzzi, Content Developmental Manager; Louis Forgione, Senior Book Designer; Rachel E. McMullen, Senior Project Manager; Catherine Jackson, Publications Services Manager; and Judith Fletcher, Global Content Development Director.

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CHAPTER 1

HISTORY OF SURGERY

IRA RUTKOW

IMPORTANCE OF UNDERSTANDING SURGICAL HISTORY

EARLY 20TH CENTURY

MODERN ERA

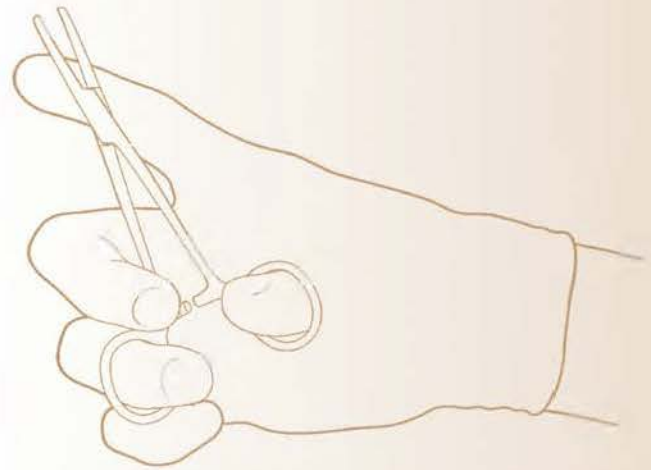
20TH CENTURY SURGICAL HIGHLIGHTS

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 adjunctive humanistic, literary, and philosophic tastes. Clearly, the study of medicine is a life-long 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 become enviable goals. In reality, there is no way to separate present-day surgery and one's own clinical practice from the experience of all surgeons and all the years that have gone before. For budding surgeons, it is a magnificent adventure to appreciate what they are currently learning within the context of past and present cultural, economic, political, and social institutions. Active physicians will find that the study of the profession—dealing, as it rightly 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 so-called modern surgery over the past 100 or so years than to the seemingly primitive practices of previous periods because the closer to the present, the more likely it is that surgical practices will resemble current practices. Nonetheless, 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 difficulty is the ever-increasing pace of scientific development in conjunction with unrelenting 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 arena of medicine to become a recognized and respected clinical physician. Similarly, it was not until the first decades of the 20th century that surgery could be considered to have achieved the status of a bona fide profession. Before this time, the scope of surgery remained limited. Surgeons, or at least those medical men who used the sobriquet *surgeon*, whether university-educated or trained in private apprenticeships, at best treated only simple fractures, dislocations, and abscesses and occasionally performed amputations with dexterity, but also with high mortality rates. They managed to ligate major arteries for common and accessible aneurysms and made heroic attempts to excise external tumors. Some individuals focused on the treatment of anal fistulas, hernias, cataracts, and bladder stones. Inept attempts at reduction of incarcerated and strangulated hernias were made and, hesitatingly, rather rudimentary colostomies or ileostomies were created by simply incising the skin over an expanding intra-abdominal mass, which represented the end stage of a long-standing intestinal obstruction. Compound fractures of the limbs, with attendant sepsis, remained mostly unmanageable, with staggering morbidity being a likely surgical outcome. Although a few bold surgeons endeavored to incise the abdomen in the hope of dividing obstructing bands and adhesions, abdominal and other types of intrabody surgery were almost unknown.

Despite it all, including an ignorance of anesthesia and antisepsis tempered with the not uncommon result of the patient suffering from or succumbing to the effects of a surgical operation (or both), surgery was long considered an important and medically valid therapy. This seeming paradox, in view of the terrifying nature of surgical intervention, its limited technical scope, and its damning 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, cataracts, hernias) and would treat the problem in as rational a 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 breathtaking advances made in pathologic anatomy and experimental physiology during the 18th and first part of the 19th centuries, physicians would soon adopt a therapeutic viewpoint 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 brought about such dramatic results in the classification, diagnosis, and treatment of disease, the rapid ascent of mid-19th century internal medicine might seem more 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 the rapid introduction of startling new technical advances was based on a simple culminating 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. Method of controlling hemorrhage and maintaining intraoperative hemostasis
3. Anesthesia to permit the performance of pain-free procedures
4. Explanation of the nature of infection, along with the elaboration of methods necessary to achieve an antiseptic 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 physicians. Moreover, 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 overwhelmingly as that of the Brussels-born Andreas Vesalius



FIGURE 1-1 Andreas Vesalius (1514-1564).

(1514-1564; Fig. 1-1). As professor of anatomy and surgery in 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 fuller and more detailed descriptions of 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 diener-like individual while the perched physician-surgeon lectured by reading from an orthodox anatomic text from on high. This principle of hands-on education would remain Vesalius' most important and long-lasting contribution to the teaching of anatomy. Vesalius' Latin *litterae scriptae* ensured 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 over the next 2 centuries, the work would go through numerous adaptations, editions, and revisions, although always remaining an authoritative anatomic text.

Method of Controlling Hemorrhage

The position of Ambroise Paré (1510-1590) in the evolution of surgery remains of supreme importance (Fig. 1-2). He played



FIGURE 1-2 Ambroise Paré (1510-1590).

the major role in reinvigorating and updating Renaissance surgery and represents 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, Paré was engaged as an army surgeon, during which time he accompanied different French armies on their military expeditions, or was 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, Paré's use of a less irritating emollient of egg yolk, rose oil, and turpentine brought him lasting fame and glory. His ability to articulate such a finding in a number of textbooks, all written in the vernacular, allowed his writings to reach more than just the educated elite. Among Paré's important corollary observations was that when 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 oleum. Described in his *Dix Livres de la Chirurgie avec le Magasin des Instruments Necessaires à Icelle* (1564), the free or cut end of a blood vessel was doubly ligated and the ligature was allowed to remain undisturbed in situ until, as a result of local suppuration, it was cast off. Paré humbly attributed his success with patients to God, as noted in his famous motto, "*Je le pansay. Dieu le guérit*,"—that is, "I treated him. God cured him."

Pathophysiologic Basis of Surgical Diseases

Although it would be another 3 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). Considered one of the most influential surgeons of all time, his endeavors stand out because of the prolificacy of his written word and the quality of his research, especially in using



FIGURE 1-3 John Hunter (1728-1793).

experimental animal surgery as a way to understand the pathophysiologic basis of surgical diseases. Most impressively, Hunter relied little on the theories of past authorities but rather on personal observations, with his fundamental pathologic studies first described in the renowned textbook *A Treatise on the Blood, Inflammation, and Gun-Shot Wounds* (1794). Ultimately, his voluminous research and clinical work resulted in a collection of more than 13,000 specimens, which became one of his most important legacies to the world of surgery. It represented a unique warehousing of separate organ systems, with comparisons of these systems—from the simplest animal or plant to humans—demonstrating the interaction of structure and function. For decades, Hunter's collection, housed in England's Royal College of Surgeons, remained the outstanding museum of comparative anatomy and pathology in the world, until a World War II Nazi bombing attack of London created a conflagration that destroyed most of Hunter's assemblage.

Anesthesia

Since time immemorial, the inability of surgeons to complete pain-free operations had been among the most terrifying of medical problems. In the preanesthetic era, surgeons were forced to be more concerned about the speed with which an operation was completed than with the clinical efficacy of their dissection. In a similar vein, patients refused or delayed surgical procedures for as long as possible to avoid the personal horror of experiencing the surgeon's knife. Analgesic, narcotic, and soporific agents such as hashish, mandrake, and opium had been used for thousands of years. However, the systematic operative invasion of body cavities and the inevitable progression of surgical history could not occur until an effective means of rendering a patient insensitive to pain was developed.

As anatomic knowledge and surgical techniques improved, the search for safe methods to prevent pain became more pressing. By the early 1830s, chloroform, ether, and nitrous oxide had been discovered and so-called 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 so-called professors of chemistry traveled to hamlets, towns, and cities to lecture on and demonstrate 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 remove a small, congenital vascular tumor of the neck painlessly. 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 inhalational anesthesia. News of the momentous event spread rapidly throughout the United States and Europe, and 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 physicians 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 a mystical craft to some. 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. It was this very mysticism, however, 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 the advent of inhalational 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. However, if anesthesia had never been conceived, a surgical procedure could still be performed, albeit with much difficulty. Such was not the case with listerism. Without antisepsis and asepsis, major surgical operations more than likely ended in death rather than just pain. Clearly, surgery needed both anesthesia and antisepsis, but in terms of overall importance, antisepsis proved to be 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 monumental efforts to introduce systematic, scientifically



FIGURE 1-4 Joseph Lister (1827-1912).

based antisepsis in the treatment of wounds and the performance of surgical operations. He pragmatically applied others' research into fermentation and microorganisms to the world of surgery by devising a means of preventing surgical infection and securing its adoption by a skeptical profession.

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 antisepsis and, after experimenting with zinc chloride and the sulfites, decided on carbolic acid. By 1865, Lister was instilling pure carbolic acid into wounds and onto dressings. He would eventually make numerous modifications in the technique of dressings, manner of applying and retaining them, and choice of antiseptic solutions of varying concentrations. Although the carbolic acid spray remains the best remembered of his many contributions, it was eventually abandoned in favor of other germicidal substances. Lister not only used carbolic acid in the wound and on dressings but also went so far as to spray it into 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 incorrectly convinced that scrubbing created crevices in the palms of the hands where bacteria would proliferate. A second important advance by Lister was the development of sterile absorbable sutures. He believed that much of the deep suppuration found in wounds was created by previously contaminated silk ligatures. Lister evolved a carbolized catgut suture that was better than any previously produced. He was able to cut the ends of the ligature short, thereby closing the wound tightly and eliminating 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 listerism was an uneven and distinctly slow process, for many reasons. First, the various procedural

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changes that 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. Third, various early attempts to use antisepsis in surgery had proved abject failures, with many leading surgeons unable to replicate Lister's generally good results. Finally, and most importantly, 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 would be the first to grasp the importance of bacteriology and the germ theory. Consequently, they were 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 led to the development of sterile aprons, drapes, instruments, and sutures. Similarly, the use of face masks, gloves, hats, and operating gowns also naturally evolved. By the mid-1890s, less clumsy aseptic techniques had found their way into most European surgical amphitheaters and were approaching total acceptance by American surgeons. Any lingering doubts about the validity and significance of the momentous concepts that Lister had put forth were eliminated on the battlefields of World War I. There, the importance of just plain antisepsis became an invaluable lesson for scalpel bearers, whereas the exigencies of the battlefield helped bring about the final maturation 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 conducted by Wilhelm Roentgen (1845-1923), which led to his 1895 elucidation of x-rays. Having grown interested in the phosphorescence from metallic salts that were exposed to light, Roentgen made a chance observation when he passed a current through a vacuum tube and noticed a greenish glow coming from a screen on a shelf 9 feet away. This strange effect continued 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 significantly, 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.

EARLY 20TH CENTURY

By the late 1890s, the interactions of political, scientific, socio-economic, 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 bichloride solution abounded. Suddenly, all was clean and tidy, with 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



FIGURE 1-5 Theodor Billroth (1829-1894).

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, highlighted by 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, including 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 Peán (1830-1898), Just Lucas-Championnière (1843-1913), and Marin-Theodore Tuffiér (1857-1929); Italian surgeons, 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 its absolute encouragement 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

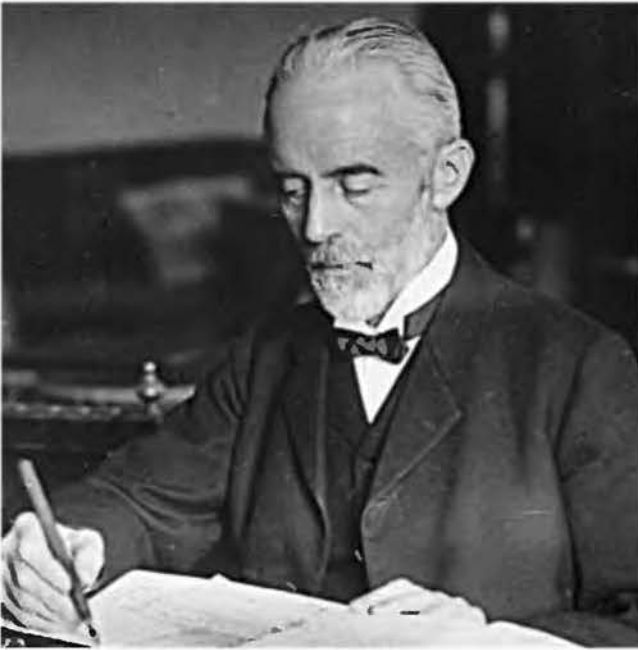


FIGURE 1-6 Theodor Kocher (1841-1917).



FIGURE 1-7 William Halsted (1852-1922).

developed. In contrast to 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 allay society's fear of the surgical unknown by presenting surgery as an accepted part of a newly established medical armamentarium. 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 the positive knowledge that an operation could eliminate potentially devastating disease processes. Accordingly, the most consequential achievement by surgeons during the early 20th century was ensuring the social acceptability of surgery as a legitimate scientific endeavor and the surgical operation as a therapeutic necessity.

Ascent of Scientific Surgery

William Stewart Halsted (1852-1922), more than any other surgeon, set the scientific tone for this most important period in surgical history (Fig. 1-7). He moved surgery from the melodramatics of the 19th-century operating theater to the starkness and sterility of the modern operating room, commingled with the privacy and soberness of the research laboratory. As professor of surgery at the newly opened Johns Hopkins Hospital and School of Medicine, Halsted proved to be a complex personality, but the impact of this aloof and reticent man would become widespread. He introduced a new surgery and showed that research based on anatomic, pathologic, and physiologic principles and the use of 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 unambiguous sequence could be constructed from the laboratory of basic surgical research to the clinical operating room. Most importantly, for surgery's own self-respect, he demonstrated during this turn of

the century renaissance in medical education that departments of surgery could command a faculty whose stature was equal in importance and prestige to that of other more academic or research-oriented fields, such as anatomy, bacteriology, biochemistry, internal medicine, pathology, and physiology.

As a single individual, Halsted developed and disseminated a different system of surgery so characteristic that it was termed 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 imprimatur. 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 bring about surgery's self-sustaining transformation from therapeutic subservience to clinical necessity.

Despite his demeanor as a professional recluse, Halsted's clinical and research achievements were overwhelming in number and scope. His residency system of training surgeons was not merely the first such program of its type—it was unique in its primary purpose. Above all other concerns, Halsted desired to establish a school of surgery that would eventually disseminate throughout the surgical world the principles and attributes that he considered sound and proper. His aim was to train able surgical teachers, not merely competent operating surgeons. There is little doubt that Halsted achieved his stated goal of producing "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 fundamental were his contributions that without them, surgery might never have fully developed and could have remained mired in a quasiprofessional state.

The heroic and dangerous nature of surgery seemed appealing in less scientifically sophisticated times, but now surgeons

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were courted for personal attributes beyond their unmitigated technical boldness. A trend toward hospital-based surgery was increasingly evident, in equal parts resulting from new, technically demanding operations and modern hospital physical structures within which surgeons could work more effectively. The increasing complexity and effectiveness of aseptic surgery, diagnostic necessity of the x-ray and clinical laboratory, convenience of 24-hour nursing, and 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 performed.

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, increasing numbers of hospitals went to great lengths to supply their surgical staffs with the finest facilities in which to complete operations. For centuries, surgical operations had been performed under the illumination of sunlight, candles, or both. 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 on 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 Küttner (1870-1932), director of the surgical clinic in Breslau, Germany (now known as Wrocław 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 to be important adjuncts to the professionalization process of surgery. For the most part, professional societies began as a means 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 guard so-called trade secrets closely, 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 a written record was also established for circulation 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 updating and continuing the education of surgeons.

World War I

Austria-Hungary and Germany continued as the dominant 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), especially to 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 antiseptic solutions and various types of surgical dressing. A principle of wound treatment entailing 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 in 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



FIGURE 1-8 Alexis Carrel (1873-1944).

reconstructive facial surgery and the treatment of fractures resulting from gunshot wounds.

American College of Surgeons

For American surgeons, the years just before World War I were a time of active coalescence into various social and educational organizations. The most important and influential of these societies was the American College of Surgeons, founded in 1913 by Franklin Martin (1857-1935), a Chicago-based gynecologist. Patterned after the Royal Colleges of Surgeons of England, Ireland, and Scotland, the American College of Surgeons established professional, ethical, and moral standards for every graduate in medicine who practiced in surgery and conferred the designation Fellow of the American College of Surgeons (FACS) on its members. From the outset, its primary aim was the continuing education of surgical physicians. 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 the local credentials committee.

In view of the stipulated peer recommendations, many physicians, realistically or not, viewed the American College of Surgeons as an elitist organization. With an obvious so-called blackball system built into the membership requirements, there was a difficult to deny belief that many surgeons who were immigrants, females, or members of particular religious and racial minorities were granted fellowships sparingly. Such inherent bias, in addition to questionable accusations of fee splitting along with unbridled contempt of certain surgeons' business practices, resulted in some very prominent American surgeons never being permitted the privilege of membership.

The 1920s and beyond proved to be a prosperous time for American society and its surgeons. After all, the history of world surgery in the 20th century is more a tale of American triumphs than it ever was in the 18th or 19th centuries. Physicians' incomes dramatically increased and surgeons' prestige, aided by the ever-mounting successes of medical science, became securely established in American culture. Still, a noticeable lack of standards and regulations in surgical specialty practice became a serious concern to leaders in the profession. The difficulties of World War I had greatly accentuated this realistic need for specialty standards, when many of the physicians who were self-proclaimed surgical specialists were found to be unqualified by military examining boards. In ophthalmology, for example, more than 50% of tested individuals were deemed unfit to treat diseases of the eye.

It was an unmistakable reality that there were no established criteria with which to distinguish a well-qualified ophthalmologist from an upstart optometrist or to clarify the differences in clinical expertise between a well-trained, full-time ophthalmologic specialist and an inadequately trained, part-time general physician-ophthalmologist. In recognition of the gravity of the situation, the self-patrolling concept of a professional examining board, sponsored by leading voluntary ophthalmologic organizations, was proposed as a mechanism for certifying competency. In 1916, uniform standards and regulations were set forth in the form of minimal educational requirements and written and oral examinations, and the American Board for Ophthalmic Examinations, the country's first, was formally incorporated. By 1940, six additional surgical specialty boards were established—orthopedic (1934), colon and rectal (1934),

urologic (1935), plastic (1937), surgical (1937), and neurologic (1940).

As order was introduced into surgical specialty training and the process of certification matured, it was apparent that the continued growth of residency programs carried important implications for the future structure of medical practice and the social relationship of medicine to overall society. Professional power had been consolidated, and specialization, which had been evolving since the time of the Civil War, was now recognized as an essential, if not integral, part of modern medicine. Although the creation of surgical specialty boards was justified under the broad imprimatur of raising the educational status and evaluating the clinical competency of specialists, board certification undeniably began to restrict entry into the specialties.

As the specialties evolved, the political influence and cultural authority enjoyed by the profession of surgery were growing. This socioeconomic strength was most prominently expressed in reform efforts directed toward the modernization and standardization of America's hospital system. Any vestiges of so-called kitchen surgery had essentially disappeared, and other than numerous small private hospitals predominantly constructed by surgeons for their personal use, the only facilities in which major surgery could be adequately conducted and post-operative patients appropriately cared for were the well-equipped and physically impressive modern hospitals. Thus, the American College of Surgeons and its expanding list of fellows had a strong motive to ensure that America's hospital system was as up to date and efficient as possible.

On an international level, surgeons were confronted with the lack of any formal organizational body. Not until the International College of Surgeons was founded in 1935 in Geneva would such a society exist. At its inception, this organization was intended to serve as a liaison to the existing colleges and surgical societies in the various countries. However, its goals of elevating the art and science of surgery, creating greater understanding among the surgeons of the world, and affording a means of international postgraduate study never came to full fruition, in part because the American College of Surgeons adamantly opposed the establishment—and continues to do so—of a viable American chapter of the International College of Surgeons.

Women Surgeons

One of the many overlooked areas of surgical history concerns the involvement of women. Until recent times, women's options for obtaining advanced surgical training were severely restricted. The major reason was that through the mid-20th century, only a handful of women had performed enough surgery to become skilled mentors. Without role models and with limited access to hospital positions, the ability of the few practicing female physicians to specialize in surgery seemed an impossibility. Consequently, women surgeons were forced to use different career strategies than men and 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



FIGURE 1-9 Olga Jonasson (1934-2006). (Courtesy University of Illinois, Chicago.)

(1851-1901) would act as a nidus toward greater gender equality in 20th century surgery. Olga Jonasson (1934-2006; Fig. 1-9), a pioneer in the field of clinical transplantation, played a leading role in encouraging women to enter the modern, male-dominated world of surgery. In 1987, when she was named chair of the department of surgery at Ohio State University College of Medicine, Jonasson became the first woman in the United States to head an academic surgery department at a coeducational medical school.

African American Surgeons

There is little disputing the fact that both gender and racial bias have influenced 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 so-called 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 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, African American physicians joined together in 1895 to form the National Medical Association. Black surgeons identified an even more specific need when the Surgical Section of the



FIGURE 1-10 Charles Drew (1904-1950).

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 examples of organized, so-called "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 suggests that denials based on race were clandestinely conducted throughout much of the country. As late as the mid-1940s, Charles Drew (1904-1950; Fig. 1-10), 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 so-called nationally representative surgical society had, in his opinion, not yet begun to accept capable and well-qualified African American surgeons freely. Claude H. Organ, Jr. (1926-2005; Fig. 1-11), was a distinguished editor, educator, and historian. Among his books, the two-volume *A Century of Black Surgeons: The U.S.A. Experience* and the authoritative *Noteworthy Publications by African-American Surgeons* underscored the numerous contributions made by African American surgeons to the nation's health care system. In addition, as the long-standing editor-in-chief of *Archives of Surgery*, as well as serving as president of the American College of Surgeons and chairman of the American Board of Surgery, Organ wielded enormous influence over the direction of American surgery.

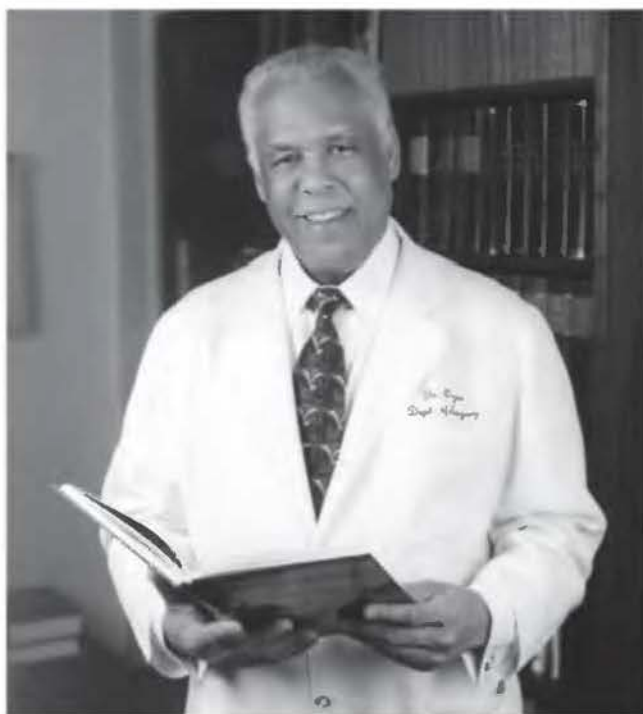


FIGURE 1-11 Claude H. Organ, Jr. (1926-2005). (Courtesy the American College of Surgeons, Chicago, and Dr. James C. Thompson.)



FIGURE 1-12 Alfred Blalock (1899-1964).

MODERN ERA

Despite the global economic depression in the aftermath of World War I, 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. 1-12), Dallas Phemister (1882-1951), and Charles Huggins (1901-1997) became world-renowned surgeon-scientists.

Much as the ascendancy of the surgeon-scientist brought about changes in the way in which the public and 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 largely been defined by its tools. From the crude flint instruments of ancient peoples, through the simple tonsillotomes and lithotrites of the 19th century, up to the increasingly complex surgical instruments developed in the 20th century, new and improved instruments usually led to a better surgical result. Progress in surgical instrumentation and surgical techniques went hand in hand.

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. In fact, within a short half-century, 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 technical surgical mysteries left. What surgery now needed to sustain its continued growth was the ability to diagnose surgical diseases at an earlier stage, locate malignant growths while they remained small, and have more effective postoperative treatment so that patients could survive ever more technically complex operations. Such thinking was exemplified by the introduction of cholecystography in 1924 by Evarts Graham (1883-1957) and Warren Cole (1898-1990). In this case, an emerging scientific technology 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 where few had previously existed. If surgery was to grow, large numbers of individuals with surgical diseases were needed.

It was an exciting era for surgeons, with important clinical advances being made in the operating room and basic science laboratory. Among the most notable highlights were the introduction in 1935 of pancreaticoduodenectomy for cancer of the pancreas by Allen Oldfather Whipple (1881-1963) and a report in 1943 on vagotomy for the operative treatment of peptic ulcer disease by Lester Dragstedt (1893-1976). Other significant advances included the following:

- Frank Lahey (1880-1953) stressed the importance of identifying the recurrent laryngeal nerve during the course of thyroid surgery.
- Owen Wangenstein (1898-1981) successfully decompressed mechanical bowel obstructions by using a newly devised suction apparatus in 1932.
- George Vaughan (1859-1948) successfully ligated the abdominal aorta for aneurysmal disease in 1921.
- Max Peet (1885-1949) presented splanchnic resection for hypertension in 1935.
- Walter Dandy (1886-1946) performed intracranial section of various cranial nerves in the 1920s.
- Walter Freeman (1895-1972) described prefrontal lobotomy as a means of treating various mental illnesses in 1936.
- Harvey Cushing (1869-1939) introduced electrocoagulation in neurosurgery in 1928.
- Marius Smith-Petersen (1886-1953) described a flanged nail for pinning a fracture of the neck of the femur in 1931 and introduced Vitallium cup arthroplasty in 1939.
- Vilray Blair (1871-1955) and James Brown (1899-1971) popularized the use of split-skin grafts to cover large areas of granulating wounds.
- Earl Padgett (1893-1946) devised an operative dermatome that allowed calibration of the thickness of skin grafts in 1939.
- Elliott Cutler (1888-1947) performed a successful section of the mitral valve for relief of mitral stenosis in 1923.
- Everts Graham completed the first successful removal of an entire lung for cancer in 1933.
- Claude Beck (1894-1971) implanted pectoral muscle into the pericardium and attached a pedicled omental graft to the surface of the heart, thus providing collateral circulation to that organ, in 1935.
- Robert Gross (1905-1988) reported the first successful ligation of a patent arterial duct in 1939 and resection for coarctation of the aorta with direct anastomosis of the remaining ends in 1945.
- John Alexander (1891-1954) resected a saccular aneurysm of the thoracic aorta in 1944.

With such a wide variety of technically complex surgical operations now possible, it had clearly become impossible for any single surgeon to master all the manual skills and pathophysiologic knowledge necessary to perform such cases. Therefore, by the middle of the century, a consolidation of professional power inherent in the movement toward specialization, with numerous individuals restricting their surgical practice to one highly structured field, had become among the most significant and dominating events in 20th century surgery. Ironically, the United States, which had been much slower than European countries to recognize surgeons as a distinct group of clinicians separate from physicians, would now spearhead this move toward surgical specialization with great alacrity. Clearly, the course of surgical fragmentation into specialties and subspecialties was gathering tremendous speed as the dark clouds of World War II settled over the world. The socioeconomic and political ramifications of this war would bring about a fundamental change in the way that 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 though 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 home towns. Large urban and community hospitals established surgical education and training programs and found it relatively easy 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 broadcast on a network 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 awarding of the Nobel Prize in medicine and physiology. Society's continued approbation of surgery's accomplishments can be seen in the naming of nine surgeons as Nobel laureates (Table 1-1).

Cardiac Surgery and Organ Transplantation

Two clinical developments truly epitomized the magnificence 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. The late 19th and 20th centuries witnessed a steady march of surgical triumphs in opening successive cavities of the body, but the final achievement awaited the perfection of methods for surgical operations in the thoracic space.

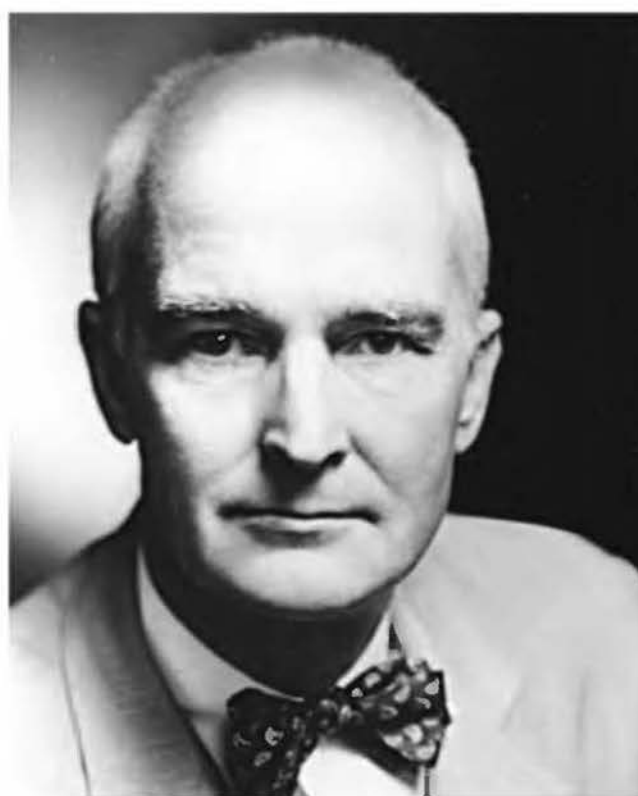
Such a scientific and technologic accomplishment can be traced back to the repair of cardiac stab wounds by direct suture and the earliest attempts at fixing faulty heart valves. As triumphant as Luther Hill's (1862-1946) first known successful suture of a wound that penetrated a cardiac chamber was 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

Table 1-1 Nobel Laureate Surgeons in Medicine and Physiology

| SURGEON | COUNTRY | FIELD (YEAR OF AWARD) |
|-------------------------------|--------------------------|--------------------------------|
| Theodor Kocher (1841-1917) | Switzerland | Thyroid disease (1909) |
| Allvar Gullstrand (1862-1930) | Sweden | Ocular dioptrics (1911) |
| Alexis Carrel (1873-1944) | France and United States | Vascular surgery (1912) |
| Robert Bárány (1876-1936) | Austria | Vestibular disease (1914) |
| Frederick Banting (1891-1941) | Canada | Insulin (1922) |
| Walter Hess (1881-1973) | Switzerland | Midbrain physiology (1949) |
| Werner Forssmann (1904-1979) | Germany | Cardiac catheterization (1956) |
| Charles Huggins (1901-1997) | United States | Oncology (1966) |
| Joseph Murray (1919-) | United States | Organ transplantation (1990) |

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 progressively refined and evolved into the open commissurotomy repair used today.

Despite mounting clinical successes, surgeons who operated on the heart had to contend not only with the quagmire of blood flowing through an area in which difficult dissection was taking place, but also with the unrelenting to and fro movement of a beating heart. Technically complex cardiac repair procedures could not be developed further until these problems were solved. John Gibbon (1903-1973; Fig. 1-13) addressed this enigma by devising a machine that would take on the work of the heart and lungs while the patient was under anesthesia, in essence pumping oxygen-rich blood through the circulatory system while bypassing the heart so that the organ could be operated on at leisure. The first successful open heart operation in 1953, conducted with the use of a heart-lung machine, was a momentous surgical contribution. Through single-mindedness of purpose, Gibbon's research paved the way for all future cardiac surgery, including procedures for correction of congenital heart defects, repair of heart valves, revascularization operations, and heart transplantation. David Sabiston (1924-2009; Fig. 1-14) was an inspirational surgical leader who served 30 years as chairman of the department of surgery at Duke University. Trained under Alfred Blalock at Johns Hopkins, Sabiston performed early and innovative coronary artery bypass operations that paved the way for more effective cardiac surgery procedures. Sabiston assumed numerous leadership roles throughout his career, including President of the American College of Surgeons, the American Surgical Association, and the American Association for Thoracic Surgery. As an eminent editor-in-chief, he guided the *Annals of Surgery* for 25 years and oversaw six previous editions of this text, the legendary *Sabiston Textbook of Surgery: The Biological Basis of Modern Surgical Practice*. Michael DeBakey (1908-2008; Fig. 1-15) was a renowned cardiac and vascular surgeon, clinical researcher, medical educator, and international medical statesman, who was the long-time Chancellor of Baylor College of Medicine and senior attending surgeon of the Methodist Hospital in Houston. He pioneered the use of Dacron grafts to replace or repair blood vessels, invented the

**FIGURE 1-13** John Gibbon (1903-1973).

roller pump, developed ventricular assist devices, was among the first to perform a coronary artery bypass and carotid endarterectomy, demonstrated the link between cigarette smoking and lung cancer, and created an early version of what became the mobile army surgical hospital or MASH unit. DeBakey was an influential advisor to the federal government about health care policy and served as chairman of the President's Commission on Heart Disease, Cancer, and Stroke during the Johnson administration. Among DeBakey's numerous honors were the Presidential Medal of Freedom, Congressional Gold Medal, and Lasker Clinical Medical Research Award.



FIGURE 1-14 David Sabiston (1924-2009). (From Anderson R: David C. Sabiston, Jr, MD. *J Thorac Cardiovasc Surg* 137:1307-1308, 2009.)



FIGURE 1-15 Michael DeBakey (1908-2008). (Courtesy Baylor College of Medicine, Houston.)

Since time immemorial, the focus of surgery was mostly on excision and repair. However, beginning in the 20th century, the opposite end of the surgical spectrum—reconstruction and transplantation—became realities. Experience in the 19th century had shown that skin and bone tissues could be auto-transplanted from one site to another in the same patient. It would take the horrendous and mutilating injuries of World War I to advance skin transplantation decisively and legitimize the concept of surgery as a method of reconstruction. With Harold Gillies (1882-1960) of England and Vilray Blair of the United States establishing military-based plastic surgery units to deal with complex maxillofacial injuries, a turning point in the way in which society viewed surgery's *raison d'être* occurred. Now,

not only would surgeons enhance nature's healing powers, but they could also dramatically alter what had previously been little more than one's physical foregone conclusion. For example, Hippolyte Morestin (1869-1919) described a method of mammaplasty in 1902. John Staige Davis (1872-1946) of Baltimore popularized a manner of splinting skin grafts and later wrote the first comprehensive textbook on this new specialty, *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 the mid-20th century, the very thought of successfully transplanting worn-out or unhealthy body parts verged on scientific fantasy. At the beginning of the 20th century, Alexis Carrel had developed revolutionary new suturing techniques to anastomose the smallest of blood vessels. Using his surgical élan on experimental animals, Carrel began to transplant kidneys, hearts, and spleens. Technically, his research was a success, but some unknown biologic process always led to rejection of the transplanted organ and death of the animal. By the middle of the 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 blazed the way, and it was not long before many organs and even hands and faces were being replaced.

Political and Socioeconomic Influences

Despite the 1950s and 1960s witnessing some of the most magnificent advances in the history of surgery, political and socioeconomic influences were starting to overshadow many of the clinical triumphs by the 1970s. It was the beginning of a schizophrenic existence for surgeons in that complex and dramatic lifesaving operations were completed to innumerable accolades whereas concurrently public criticism of the economics of medicine, in particular, high-priced surgical practice, portrayed the scalpel holder as a greedy, financially driven, selfish individual. This was in stark contrast to the relatively selfless and sanctified 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 dramatic and theatrical features 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 them. There is the precise and definitive nature of surgical intervention, expectation of success that surrounds an operation, short time frame in which outcomes are realized, high income levels of most surgeons, and almost insatiable inquisitiveness of lay individuals about all aspects of the act of consensually cutting into another human's flesh. These phenomena, ever more sensitized in this age of mass media and instantaneous telecommunication, make surgeons seem more accountable than their medical colleagues and, simultaneously, symbolic of the best and worst in medicine. In ways that were previously unimaginable, this vast social

transformation of surgery controls the fate of the individual physician in the present era to a much greater extent than surgeons as a collective force can 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 writings. Although many justly famous names might be missing, the following description of surgical advances is intended to highlight some of the stunning clinical achievements of the past century chronologically.

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 on 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, 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 of 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 caused by extension along lymphatic vessels and not by 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 technique of abdominoperineal resection in 1908, the same year that Friedrich Trendelenburg (1844-1924) attempted pulmonary embolotomy. Martin Kirschner (1879-1942) of Germany described a wire for skeletal traction and for stabilization of bone fragments or joint immobilization 3 years later. 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 began to use living bone grafts as internal splints. Wilhelm Ramstedt (1867-1963), a German surgeon, described a pyloromyotomy (1912) at the same time that Pierre Fredet (1870-1946) was reporting a similar operation. In 1913, Henry Janeway (1873-1921) of New York developed a technique for gastrostomy in which he wrapped the anterior wall of the stomach around a catheter and sutured it in place, thereby 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 Gallie (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. Reynaldo dos Santos (1880-1970), a Portuguese urologist, reported the first translumbar aortogram 5 years later. Cecil Joll (1885-1945), professor of surgery in London, described the treatment of thyrotoxicosis by means of subtotal thyroidectomy in the 1930s.

In 1931, George Cheatele (1865-1951), professor of surgery in London, and Max Cutler (1899-1984), a surgeon from New York, published their important treatise, *Tumours of the Breast*. In that same year, Cutler detailed his systemic use of ovarian hormone for 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 radium treatment for 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 an arteriectomy for arterial thrombosis in 1937 and, later, periarterial sympathectomy to improve arterial flow. Leriche also described 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. 1-16), a pioneer in endocrine therapy for cancer, found that antiandrogenic treatment consisting of orchiectomy or the administration of estrogens could produce long-term regression in patients with advanced prostatic cancer. These observations formed the basis for the current treatment of prostate and breast cancer by hormonal manipulation; Dr. Huggins was awarded the Nobel Prize in 1966 for these



FIGURE 1-16 Charles Huggins (1901-1997). (Used with permission from the University of Chicago Hospitals, Chicago.)



FIGURE 1-17 Francis D. Moore (1913-2001).

monumental discoveries. Clarence Crafoord (1899-1984) pioneered his surgical treatment of coarctation of the aorta in 1945. The following year, Willis Potts (1895-1968) completed an anastomosis of the aorta to a pulmonary vein for certain types of congenital heart disease. Chester McVay (1911-1987) popularized a repair of groin hernias based on the pectineal ligament in 1948.

Working at Georgetown University Medical Center in Washington, DC, Charles Hufnagel (1916-1989) designed and inserted the first workable prosthetic heart valve in a man (1951). That same year, Charles Dubost (1914-1991) of Paris performed the first successful resection of an abdominal aortic aneurysm and insertion of a homologous graft. Robert Zollinger (1903-1994) and Edwin Ellison (1918-1970) first described their eponymic polyendocrine adenomatosis in 1955. The following year, Donald Murray (1894-1976) completed the first successful aortic valve homograft. At the same time, John Merrill (1917-1986) was performing the world's first successful homo-transplantation of the human kidney between identical twin brothers. Francis D. Moore (1913-2001; **Fig. 1-17**) defined objectives of metabolism in surgical patients and in 1959 published his widely quoted book, *Metabolic 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. 1-18**), in collaboration with colleagues Harry Vars and Stan Dudrick, described the technique of total parenteral nutrition, which has become an important and lifesaving treatment for the management of a critically ill patient who cannot tolerate standard enteral feedings. James D. Hardy (1918-2003), at the University of Mississippi, performed the first lung (1963) and heart (1964) transplants in a human. Judah



FIGURE 1-18 Jonathan Rhoads (1907-2002). (Courtesy Dr. James C. Thompson.)



FIGURE 1-19 Judah Folkman (1933-2008). (Courtesy Children's Hospital, Boston.)

Folkman (1933-2008; Fig. 1-19) was surgeon-in-chief at Children's Hospital in Boston, where he devoted much of his time to basic science research. He was best known for his studies on angiogenesis, the process whereby a tumor forms blood vessels to nourish itself and grow. Folkman's work led to antiangiogenesis therapy—the concept that cancers can be contained by using chemotherapeutic agents to inhibit their blood supply.

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 manually 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 manage them effectively. Many splendid schools of surgery now exist in almost every major industrialized city, but none can lay claim to dominance in all the disciplines that comprise surgery. Similarly, 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 that “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 many magnificent personalities and outstanding scientific and social achievements, may not necessarily help us predict the future of surgery. However, it does shed much light on current clinical practices. To a certain extent, if surgeons in the future wish to be regarded as more than mere technicians, the profession needs to appreciate the value of its past experiences better. 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.

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18 SECTION I SURGICAL BASIC PRINCIPLES

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Thorwald J: *The Triumph of Surgery*, New York, 1960, Pantheon.

In a most dramatic literary fashion, Thorwald uses a fictional eyewitness narrator to create continuity in the story of the development of surgery during its most important decades of growth, the late 19th and early 20th centuries. Imbued with a myriad of true historical facts, these books are among the most enjoyable to be found within the genre of surgical history.

Wangensteen OH, Wangenstein SD: *The Rise of Surgery, from Empiric Craft to Scientific Discipline*, Minneapolis, 1978, University of Minnesota Press.

Not a systematic history but an assessment of various operative techniques (e.g., gastric surgery, tracheostomy, ovariectomy, vascular surgery) and technical factors (e.g., débridement, phlebotomy, surgical amphitheater, preparations for surgery) that contributed to or retarded the evolution of surgery. Wangenstein was a noted teacher of experimental and clinical surgery at the University of Minnesota and his wife was an accomplished medical historian.

Zimmerman LM, Veith I: *Great Ideas in the History of Surgery*, Baltimore, 1961, Williams & Wilkins.

Zimmerman, late professor of surgery at the Chicago Medical School, and Veith, a masterful medical historian, provide well-written biographic narratives to accompany numerous readings and translations from the works of almost 50 renowned surgeons of varying eras.

CHAPTER 2

ETHICS AND PROFESSIONALISM IN SURGERY

CHERYL E. VAIANI AND HOWARD BRODY

THE IMPORTANCE OF ETHICS IN SURGERY

END-OF-LIFE CARE

CULTURAL SENSITIVITY

SHARED DECISION MAKING

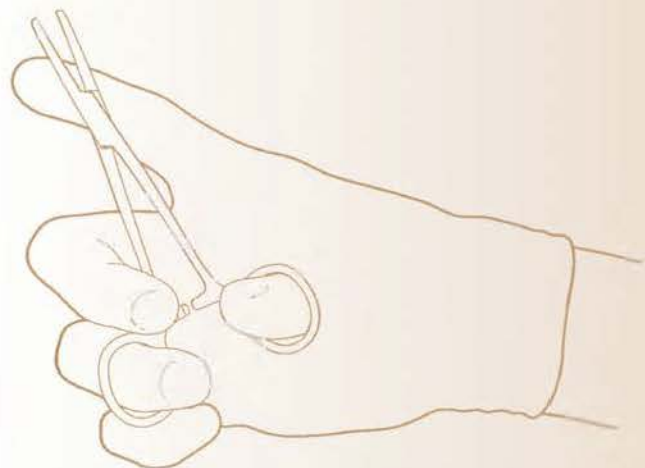
PROFESSIONALISM

CONCLUSION

THE IMPORTANCE OF ETHICS IN SURGERY

Although the ethical precepts of respect for persons, beneficence, nonmaleficence, and justice have been fundamental to the practice of medicine since ancient times, ethics has assumed an increasingly visible and codified position in health care over the past 50 years. The Joint Commission, the courts, presidential commissions, medical school and residency curriculum planners, professional organizations, the media, and the public have all grappled with determining the right course of action in health care matters. The explosion of medical technology and knowledge, changes in the organizational arrangement and financing of the health care system, and challenges to traditional precepts posed by the corporatization of medicine have all created new ethical questions.

The practice of medicine or surgery is, at its center, a moral enterprise. Although clinical proficiency and surgical skill are crucial, so are the moral dimensions of a surgeon's practice. According to sociologist Charles Bosk, the surgeon's actions and patient outcome are more closely linked in surgery than in medicine, and that linkage dramatically changes the relationship between surgeon and patient.¹ Surgeon and humanist Miles Little has suggested that there is a distinct moral domain within the surgeon-patient relationship. According to Little, "testing and negotiating the reality of the category of rescue, negotiating the inherent proximity of the relationship, revealing the nature of the ordeal, offering and providing support through its course, and being there for the other in the aftermath of the surgical encounter, are ideals on which to build a distinctively surgical ethics."² Because surgery is an extreme experience for the patient, surgeons have a unique opportunity to understand their patients' stories and provide support for them. The virtue and duty of engaged presence as described by Little extends beyond a warm, friendly personality and can be taught by both precept and example. Although Little does not specifically identify trust as a component of presence, it seems inherent to the moral



depth of the surgeon-patient relationship. During surgery the patient is in a totally vulnerable position and a high level of trust is demanded for the patient to place his or her life directly in the surgeon's hands. Such trust, in turn, requires that the surgeon strive to act always in a trustworthy manner.

From the Hippocratic Oath to the 1847 American Medical Association statement of medical principles through the present, the traditional ethical precepts of the medical profession have included the primacy of patient welfare. The American College of Surgeons was founded in 1913 on the principles of high-quality care for the surgical patient and the ethical and competent practice of surgery. The preamble to its Statement on Principles states the following³:

The American College of Surgeons has had a deep and effective concern for the improvement of patient care and for the ethical practice of medicine. The ethical practice of medicine establishes and ensures an environment in which all individuals are treated with respect and tolerance; discrimination or harassment on the basis of age, sexual preference, gender, race, disease, disability, or religion, are proscribed as being inconsistent with the ideals and principles of the American College of Surgeons.

The Code of Professional Conduct continues⁴:

As Fellows of the American College of Surgeons, we treasure the trust that our patients have placed in us, because trust is integral to the practice of surgery. During the continuum of pre-, intra-, and post-operative care, we accept responsibilities to:

- Serve as effective advocates of our patients' needs.
- Disclose therapeutic options, including their risks and benefits.
- Disclose and resolve any conflict of interest that might influence decisions regarding care.
- Be sensitive and respectful of patients, understanding their vulnerability during the perioperative period.
- Fully disclose adverse events and medical errors.
- Acknowledge patients' psychological, social, cultural, and spiritual needs.
- Encompass within our surgical care the special needs of terminally ill patients.
- Acknowledge and support the needs of patients' families.
- Respect the knowledge, dignity, and perspective of other health care professionals.