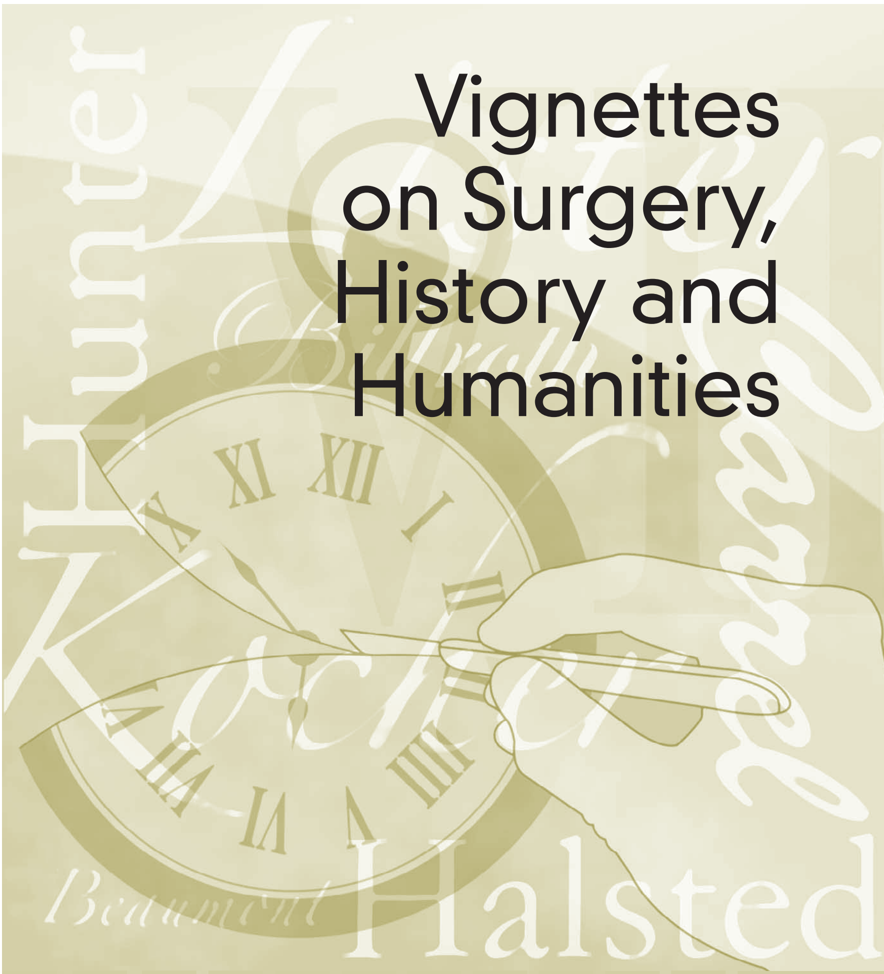
LANDES BIOSCIENCE

Vademecum

Vignettes on Surgery, History and Humanities



Luis H. Toledo-Pereyra

LANDES BIOSCIENCE
Vademecum
Vignettes on Surgery, History and Humanities
Toledo-Pereyra

vademecum

Vignettes on Surgery, History and Humanities

Luis H. Toledo-Pereyra
Michigan State University
Kalamazoo Center for Medical Studies
Borgess Research Institute
Western Michigan University
Kalamazoo, Michigan, U.S.A.

LANDES
BIOSCIENCE
GEORGETOWN, TEXAS
U.S.A.

VADEMECUM
Vignettes on Surgery, History and Humanities
LANDES BIOSCIENCE
Georgetown, Texas U.S.A.

Printed in the U.S.A.

Please address all inquiries to the Publisher:
Landes Bioscience, 810 S. Church Street, Georgetown, Texas, U.S.A. 78626
Phone: 512/ 863 7762; FAX: 512/ 863 0081

ISBN: 1-57059-657-3

Library of Congress Cataloging-in-Publication Data

Vignettes on surgery, history and humanities / [edited by] Luis H. Toledo-Pereyra.
p. ; cm. -- (Vademecum)
Includes bibliographical references.
ISBN 1-57059-657-3
1. Surgery--History. I. Toledo-Pereyra, Luis H. II. Title. III. Series.
[DNLM: 1. Surgery--history. 2. Surgical Procedures, Operative. WO 11.1 V684 2005]
RD19.V54 2005
617.09--dc22
2005013914

Dedication

To the masters of surgery
and those everyday practicing surgeons
who showed us the way.

Contents

Section VI. Short Editorial Notes: Philosophy and Humanities

Editor

Luis H. Toledo-Pereyra
Michigan State University
Kalamazoo Center for Medical Studies
Borgess Research Institute
Western Michigan University
Kalamazoo, Michigan, U.S.A.
Chapters: Introduction, 5, 8, 9, 11, 15, 17-19, 26-28, 31, 32, 37-39, 41-43, 45-53, Conclusion

Contributors

Filiz Aslan
Ankara Numune Teaching and Research Hospital
Ankara, Turkey
Chapter 6

Simon Bartley
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 14

Maurice Blitz
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 25

James Brooks
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 30

Mükerrem Cete
Ankara Numune Teaching and Research Hospital
Ankara, Turkey
Chapter 6

Jonathan Chaney
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 30

Melissa Chen
Vanderbilt University
School of Medicine
Nashville, Tennessee, U.S.A.
Chapter 40

Scott E. Cowie
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 20

Janet Fisher
Department of Surgery
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 36

Jason R. Francoeur
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 21

Susanne Greschus
University of Münster
Münster, Germany
Chapter 29

Jochen Son Hing
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 3

Robin Kennie
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 23

Sonja Kötting
University of Münster
Münster, Germany
Chapter 29

Herman Kwan
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 22

Erik B. Loucks
University of British Columbia
Vancouver Hospital and Health Sciences Centre
Vancouver, British Columbia
Canada
Chapters 33, 35

Raman C. Mahabir
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 3

Lucretia W. McClure
Countway Library of Medicine
Harvard Medical School
Boston, Massachusetts, U.S.A.
Chapter 44

Rod McLaren
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 22

A. Parmeggiani
Cattedra Fisiopatologia
Chirurgica-Università degli Studi di Milano
Milan, Italy
Chapter 1

Todd Peterson
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 22

Patricio Santillan-Doherty
Instituto Nacional de Ciencias Medicas y Nutricion "Salvador Zubiran"
Tlalpan, D.F., Mexico
Chapter 7

Iksender Sayek
Hacettepe University
Ankara, Turkey
Chapter 6

Ahmed Shafik
Cairo University
Cairo, Egypt
Chapter 2

Hossein Shayan
Edmonton Hospital
Edmonton, Canada
Chapter 34

Hellai Sherzoi
Scripps College Claremont
Claremont, California, U.S.A.
Chapter 13

Mahnaz Sherozi
University of Washington
Seattle, Washington, U.S.A.
Chapter 12

Atilla Soren
Ankara Numune Teaching
and Research Hospital
Ankara, Turkey
Chapter 6

A. Karim Qayumi
University of British Columbia
Vancouver Hospital and Health
Sciences Centre
Vancouver, British Columbia
Canada
Chapter 10

Tarique Qayumi
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 4

Alda L. Tam
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 3

Vincent Thien
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 24

Alexander Horacio Toledo
Department of Surgery
University of Maryland
Baltimore, Maryland, U.S.A.
Chapters 16, 41

Suzanne E. Toledo Zimmerer
Mount Sinai Hospital
New York, New York, U.S.A.
Chapter 8

Mark Trump
Department of Surgery
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 36

Alex D. Vastardis
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 3

Dong Wu
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 30

Barend Zack
University of British Columbia
Vancouver, British Columbia
Canada
Chapter 30

Introduction

The importance of medical history in the annals of surgery has been frequently underemphasized. There is so much we can learn from the deeds and examples of our predecessors. There is so much we can admire in their lives and contributions. There is so much we can use to guide our professional development.

This book introduces writings on the history and philosophy of surgery that previously appeared in the *Journal of Investigative Surgery*. These writings were selected and organized after careful analysis to include those works that demonstrated the best cohesive unit in telling about the evolution of surgery and its masters. When necessary we made corrections and added references as appeared to be required.

Our principal objective is to reach the minds and hearts of all students of surgery. This encompasses medical students interested in surgery, surgical residents learning the discipline, faculty surgeons teaching young generations of future specialists, and the practicing surgeons who are making a difference in the community. Additionally, and as importantly, this book attempts to reach students of history in general and those interested in the history and philosophy of surgery in particular.

Our lofty wish is for this book to reach the halls of academia as well as the surgical floors of general hospitals where students, residents, and staff surgeons attend their pre and postoperative patients. Our ultimate desire is that this work will appear during grand rounds and will be a constant companion in the pockets of surgical residents. We further hope that faculty members will frequently test those residents on the extraordinary value of the history of surgery and the wonderful ascent of this prestigious field of medicine.

We hope these writings will present those who read them with encouraging and realistic views of the incredible feats realized by the pioneers of surgery. We welcome new ideas and suggestions the reader might have in improving future editions of this study on the history of surgery.

I would like to recognize the works of past editors of the *Journal of Investigative Surgery*, Philip N. Sawyer, Andreas Von Recum, and A. Karim Qayumi, who magnificently pursued important topics in the history of surgery during their tenancy. I appreciate the strong encouragement and complete support received by members of the editorial staff of Taylor and Francis, Melissa James and Ed Cilurso, in particular; who were extremely helpful in obtaining and approving the use of the works previously published in the *Journal of Investigative Surgery*. The *Academy of Surgical Research* offered continuous encouragement in our academic approach to the history of surgery. Ron Landes, from Landes Bioscience, enthusiastically embraced this work and included it within the published writings of this fine editorial house. Also, I am indebted to the special support received from students of my course on the *History of American Medicine* at Western Michigan University, especially that of Stephanie Barbera and Jared Allmond, who dedicated their time to organizing the various chapters included in this work. Ralph Gordon, noted medical historian and friend, carefully reviewed this manuscript and offered critical and positive suggestions for its improvement. I thank all of them for their dedicated help.

Luis H. Toledo-Pereyra
Editor

Acknowledgment

The material for this book was previously published in the *Journal of Investigative Surgery*. We appreciate their generous permission to use the *Journal's* content for this publication.

Section I.
Surgery of Old Times

Chapter 1

Times of Surgery

A. Parmeggiani

Surgery is ancient like humanity. The first written evidence of surgical practices comes from Mesopotamia, where around 2000 years B.C. laws about surgical operation fees and professional behavior were promulgated.

In the same period, Egyptians showed their anatomical and physiological knowledge, describing the brain, its membranes, several forms of pathology including wounds, tumors, ulcers, and fractures, and many other phenomena with respective recovery processes.

Greeks and Romans drew from the Babylonian and Egyptian cultures.[1] With Hippocrates (fifth to fourth century B.C.), Greek medicine reached its climax. His *Corpus Hippocraticum* contains *De Chirurgia*, a short collection of surgical procedures in which patient location, those of the surgeon and assistants, and lighting are described together with bandaging, sutures, and more.

The most important surgical treatise of the Roman Empire is *De Re Medica*, written by Aulo Cornelio Celso (first century B.C.), in which signs of inflammation (rubor, tumor, dolor, calor) are listed and surgical procedures for phimosis, hernia, and gallbladder stones are described. Moreover, although Celso received merit for connecting the diseases that recovered through therapy and those treated by surgery, Galeno (second century B.C.) is considered the genius of this area of thought. An anatomist and physiologist, he wrote *Delle utilità delle parti e Delle preparazioni anatomiche*, which imposed his discoveries on the field for over 15 centuries. After his work, dissection was neglected.

The first rudimentary pathophysiological disease interpretation, which today appears so fanciful, was given by Asclepiade (first century B.C.), who considered health as a normal atom moving into "little channels" of the body and diseases as derangement of this movement.

For his colleague Temisone (first century B.C.), diseases resulted from an anomalous condition of body pores, which could be too tight (*status strictus*) or too wide (*status laxus*).[2]

These considerations seem to be inexact, and thus similar to Hippocrates's proposal: Health is a right proportion of four fundamental elements (blood from the heart, which represents warmth; phlegm from the brain, cold; yellow bile from the liver, dryness; and black bile from the spleen, dampness), and disease results from their abnormal relation (humoral concept). However, they permit us to understand the endeavor to explain diseases rationally as an alteration of organic homeostasis with disequilibrium among different body constituents, which became the basis for modern concepts of pathophysiological illness.

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

To these pathophysiologist standard-bearers, credit for deriving mechanisms of disease comprehension from oracle interpretation alone must be given. It was also the first effort to solicit to progress toward divine power, which would characterize the centuries following Christianity's accession.

During the Middle Ages both surgery and medicine, especially anatomical concepts, underwent a regression, resulting from the belief in recovery that was derived from prayers. Surgical practice was forbidden by the clergy, and quite frequently operations were conducted by barbers.

In 1240 the Scuola Salernitana was established under the protection of Federico II. Ruggero di Frogardo wrote *Cyrurgia Rogerii*, which dictated surgical teaching and practice in Europe.

In this period Ugo and Teodorica Borgognone assured that wounds would recover better and more quickly if they were nonsuppurating, having perceived by intuition the role of pus in patients' conditions.[3,4] Critical observation of every degree of the inflammatory process may suggest whether the wound is better, either improving via natural reaction or via countering just in time any possibly inflammatory change.

Only during the Renaissance and 17th century was there a renewal in improvement of surgical techniques, with new operations carried out. The most important surgeons of this period were Giovanni da Vigo, Gabriele Falloppio, Guido Guidi, Leonardo Botallo, Fabrizio da Acquapendente, Gaspare Tagliacozzi promoting rhynoplasty, and Marco Aurelio Severino with his banding of the artery preceding the aneurismal sac.[5]

William Harvey discovered and described blood circulation from heart to arteries and veins. Marcello Malpighi completed this study, discovering capillaries.

During the 18th century, progress became methodical and systematic. Surgery was improved by study of anatomic pathology. The biggest names of the time were Francesco Chopart, the Hunters and Percival Pott, and G. B. Monteggia.[6]

In the 19th century three elements permitted surgery to make great strides, and improved patients' survival by the intuitions of G.T. Jackson, W.T. Morton, J.Y. Simpson, and I. P. Semmelweis: hemostasis, anesthesia, and antisepsis.[7,8] Operations lost the dramatic character that marked them in old times, permitting better disease management also. Surgery became a real profession, an independent branch of science, and surgeons received the honors that were denied them before.

Since those periods of extraordinary evolution of medical knowledge, every innovative contribution has shown close links with physiology.[9,10] The exact comprehension of disease mechanisms permits a pathophysiological approach to operated patients. Physicians become able to quickly eliminate noxious circumstances, reestablishing physiological homeostasis, reducing surgical disease length, avoiding unfortunate consequences, and producing faster recovery.

Pathophysiology has long been thought of as the study of alteration in an organism's normal function induced by anatomopathological lesions. This way, it was one among the other steps of pathology, moving from etiology to pathogenesis, histology, and biochemical changes, through pathophysiology to symptoms and signs.[11]

The distinction between surgical and clinical pathophysiology that is still current is arbitrary. It is simply based on therapy—natural, surgical, or clinical—so that pathophysiology aims to unify all medical knowledge. It should be thought of as the rational aspect of clinical medicine. Since the 1950s, there has appeared a requirement to make pathophysiology an autonomous discipline.

Comprehension of disease mechanisms gives several advantages for prevention, diagnosis, therapy, and follow-up until a better and correct disease management is reached. It permits us to understand eventual treatment limits, avoiding unfortunate consequences.

When cholecystectomy for gallstones is performed, it would be simplistic to think that disease is eliminated and consequences avoided. Real knowledge of gallstone formation in pathophysiological ways shows that the noxa patogena of saturated bile suspension secretion is not removed after intervention.[12] Thus, the risk of dyspepsia and subsequent primary bile duct lithiasis or pancreatopathy is still present. In this case, adequate disease management suggests that we provide immediately after the operation a dietary protocol enriched with essential integrators such as ursodeoxycholic acid, able to restore polyunsaturated bile suspension and to support liver function in all those patients at high risk for developing disease.[13]

Another example is represented by pathophysiological studies about peptic ulcer formation and the subsequent risk of stump cancer after gastric resection, ascribable to enterogastric reflux due above all to Billroth II (BII) anastomosis. Pathophysiology indicates the way to reduce this risk, suggesting for a patient different surgical management: a Roux-en-Y anastomosis instead of BII.[14]

Many other fields draw from knowledge of gastric pathophysiology. Today we know that in a patient with cranial trauma, acid secretion increases, favoring gastric ulcers onset with their possible bleeding. Therefore, it is necessary to provide H2 blockers to avoid consequences but keeping in mind this caution: An iatrogenic hypochlorydia may also induce intestinal metaplasia until development of severe dysplasia, accepted as a precancerous lesion.

A careful study of the operated-on patients permitted us to understand the relevance of biologic surveillance of protein and lipid metabolism, as well as water and electrolyte balance on which a patient's survival could depend.

The widest development has been observed in cardiovascular surgery, where collaboration among specialists in different disciplines made it possible to achieve surgical operations to correct anatomical defects at the beginning, resorting to hypothermic conditions and later to extracorporal blood circulation.

The role of pathophysiology is therefore to stimulate the evolution of new technologies to guide physicians toward quite rational choice among available armaments, especially in those human pathology fields that are still to be discovered completely. Only in this way, using the widest multidisciplinary cooperation, will we be able to realize modern, scientific, high-quality management of disease.

References

1. Castglioni A. Storia della Medicina. Milano: Mondadori, 1948.
2. De Renzi S. Storia della Medicina in Italia. Napoli, Bologna: Forni s.d. Ristampa, 1845-48.
3. Alter W. Einfuhrung in die Medizinhistorik. Stuttgart: Enke, 1949.
4. Sprengel K. Storia Prammatica della Medicina. Napoli, 1824-1827.
5. Barmbilla GA. Storia della scoperte FisicoMedicoAnatomicoChiruriene Fatte Dagli Uomini Illustri Italiani. Milano, Bologna, Forni, Ristampa 1977 1780-1782
6. Major R. Storia della Medicina. Firenze: Sansoni, 1959.
7. Corradi A. Della Chirurgia in Italia Dagli Ultimi Anni del Secolo Scorso Fino al Presente. Bologna: Gamberini e Parmeggiani, 1871.
8. Puschmann T. Hanbuch der Geschichte der Medizin. Jena-Hildesheim: OLMS, 1971-1902, Ristampa.
9. Pazzini A. Storia dell'arte Sanitaria. Torino: Minerva Medica, 1973-1974.

10. Gurtl E. Geschichte der Chirurgie und Ihrer Ausumbung. Hildhesheim-Berlin: OLMS, 1964-1898, Ristampa.
11. Giordano D. Chirurgia. Milano: Bompiani, 1938.
12. Admirand WH, Small DM. The physiochemical basis of cholesterol gallstone formation. J Clin Invest 1968; 47:1043-1052.
13. Parmeggiani A, Cortese A, Mombellie B et al. Diet, physphatidylcholine, ursodeoxycholic acid: Essential element for biolioenteric homeostasis. Long term follow up of chemical, microbiologic, gas chromatographic results on 95 patients. Int J Drug Ther X 1993(3-4):117-127.
14. Tersmette AC, Giardiello FM, Tytgat GNJ et al. Carinogenesis after remote ulcer surgery: The long-term prognosis of partial gastrectomy. Scand J Gastroenterol 1995; 30(suppl. 212):96-99.

Chapter 2

Medicine in Ancient Egypt

Ahmed Shafik

The first documentation of scientific medical observations was produced about 3000 to 2500 BC (Old Kingdom) by an unknown author who some Egyptologists believe could have been the earliest known architect-physician, Imhotep. It came down to us in the shape of a 17th century BC copy of the original papyrus. The author of this treatise had already learned that in surgery and medicine a great body of observable phenomena confronted him. Systematic and scientific compilation and organization of observations in "cases" enabled this earliest documented natural scientist to base inductive conclusions upon bodies of observed fact. The heart as a central force of a system of distributing vessels and the importance of observing its action to determine a patient's condition were already part of his knowledge some 2500 years before the cardiac system was first mentioned in Greek medicine. He had commenced to count the pulse and was becoming acquainted with the muscular system. His observation that injury to the brain or spine especially affects the lower limbs and that a dislocation of the cervical vertebrae was accompanied by a seminal emission led him to recognize the brain and spine as the centers of nervous control—an observation that has been more fully developed by modern surgeons only within the present generation. Dissection was already practiced, and adhesive tape and surgical stitching are first mentioned in that period. Amazingly, as early as 5000 years ago, the ancient surgeon was able to pronounce a diagnosis, declaring that he (1) can treat and cure, (2) can treat and try a cure, or (3) cannot treat, the case being practically hopeless. He also had a host of medical prescriptions at his disposal for treatment. In tetanus following a serious skull injury, the treatise suggests only hot applications to the constricted ligaments of the mandible. A decoction of willow, essentially salicin, was employed as a disinfectant; an ammoniacal application for allaying inflammation; and for astringent purposes, a solution containing salts of copper and sodium. A great number of ointments were in use. It is interesting to note that several of the "household remedies" of the present day treating all kind of ailments seem to represent a virtually unbroken tradition since the days of the pharaohs.

While the main document dealing with surgery is the Edwin Smith Papyrus, which is kept at the New York Academy of Sciences, our knowledge of the character of the more medical treatises has been based chiefly on the famous Papyrus Ebers at the University of Leipzig, the Berlin Medical Papyrus at the State Museum at Berlin, the London Medical Papyrus at the British Museum, and the Papyrus Hearst, now at the University of California. Besides these longer documents, only a few fragments of three other Egyptian medical documents have survived; possibly as old as before 5000 BC, they include the scanty remarks of a treatise on diseases of women

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

and fragments of a veterinary manual treating diseases of cattle. All these documents testify to the fact that the body of medical knowledge existing in the Old Kingdom was so large and detailed that it required specialization; the ancient medical system knew ophthalmologists, dental surgeons, a "guardian of the anus" (coloproctologist), a palace physician of the belly, and a supervisor of the physicians at the palace. There were books on medical science at that early age. Far in advance of medicine, surgery was creating its first technical terms. The ancient surgeon, not unlike his modern counterpart, would clarify his terms by comparing things he designated with more familiar objects. For example, the convolutions of the "brain" (a term introduced by the ancient Egyptian physician about 2000 years before it first appeared in Greek medical documents that were written in Alexandria, Egypt) he likens to the corrugations on metallic slag; the fork at the head of the ramus in the human mandible he describes as like the claw of a two-toed bird; a puncture of the cranium is like a hole broken in the side of a pottery jar; and a segment of the skull is given the name of a turtle's shell. These are the earliest known anatomical, physiological, and pathological descriptions.

What have the surgical and various medical treatises revealed about the surgical practice of the ancient Egyptian physician? Disease, by and large, was taken as entirely due to demoniac intrusions. For this reason, magic and spells are given relatively much room in many instructions for treatment. Taking a look at the instruments the ancient surgeon is said to have used, we find that none of the tools described as surgical is a documented finding from a physician's tomb. The only instruments hitherto discovered in a physician's tomb represent the carpenter's tools used in the building of the sarcophagus, rather than the professional kit of the surgeon. Nevertheless, among the tools found in museums, some are instruments similar to those in present use. An instrument whose use could have been surgical is a metal gadget that resembles the lazem used until now by Arab and Jewish circumcisers. Some hooks and "disposable" lancets and blades are fashioned from reed stems. The only graphic representation of instruments that are usually called "surgical" is the collection engraved in the Kom Ombo temple. However, it remains disputed whether these depicted instruments were in fact used for surgical procedures or if they represent tools for other purposes. Was any kind of anesthesia used in the operations at that time? Apart from sedative drugs like opium or hyoscyamus and a local anesthetic like belladonna, the ancient Egyptian surgeon applied a mixture of motley-colored marble, stone of Memphis, with water to diminish the sensitivity of the site of operation; the stone had to be ground with vinegar on the parts that were to be cauterized or incised and, by the formation of carbonic acid, would effect numbness there.

In wound treatment, the lips of clean-cut wounds were brought together by means of adhesive tape or by stitching. Other wounds were not sutured, to avoid the aggravation of infection. Fresh (ox) meat was applied as a most efficient way of preventing hemorrhage, especially if it resulted from oozing. In the following days, the dressing consisted of astringent herbs and (hygroscopic) honey, which attracts an abundant secretion of leukocytes and antibodies. Also, the application of sour or moldy bread or wood was practiced until the European Renaissance and has continued into the present day in the form of antibiotics. Burns were treated with honey, butter, oils, and other fatty substances to the accompaniment of litanies and spells.

Symptoms and consequences of fractures of the skull, ribs, and thorax and of subluxations of the vertebrae and limbs were dealt with, and the skill in reducing fractures of the clavicle and dislocations of the jaw, or in the setting of a dislocated shoulder, is demonstrated. Bark splints or wooden sticks were used to support the fractured limb, sparing the open wounds. The procedure of trepanation is not mentioned in Egyptian writings and was probably performed for magical not therapeutic purposes. The so-called "trephine skull" is in reality a case of symmetrical resorption of the parietals as a result of old age. In another skull, the frontal bone is perforated by a circular hole with an easy edge of the bevel, suggesting the use of hammer and chisel or a convex scraper with a wide radius; the edges showed perfect healing sometime before death. The same evidence of healing was also found in the frontal bone of a child, where the bevel of the 1-cm-diameter hole is very steep.

Remarkable dental surgery is documented in the extraordinary work on a mandible showing the alveolar process pierced to drain an abscess under the first molar, which dates back to 2900-2750 BC. Whether or not two slabs from the First Dynasty show a human ritual sacrifice or the performance of tracheostomy is disputed.

Circumcision in Egypt belonged to the domain of the priest rather than to the surgeons. One possible motive behind circumcision, regardless of the hygienic aspects that have been used as arguments to rationalize it, is the concept of bisexuality originating the priestly speculations over the creation of the world by single gods whom they considered both father and mother of mankind. Accordingly, every human being was believed to have both male and female souls. The male soul in girls was located in the vestigial phallus, that is, the clitoridial eminence, and the female soul in boys was placed in the prepuce, taken to represent the labia. Hence, young individual adolescents had to shed their heterosexual outfit before qualifying as integral members of their sex community. Herodotus reported that the Egyptians were the first to circumcise children, well before the Syrians and the Phoenicians, and that the Hebrews acquired from them this custom.

A series of prescriptions for swellings is believed to be the remains of a book on tumors. To establish a diagnosis, the Egyptian physician had to carefully note the shape and aspect of the tumor: hemispherical, protuberant "as if to proclaim its presence," serpentine, blown out, knotty, red, colored, motley, having one or numerous heads, having or not having pierced through the skin, causing mutilations, etc. By palpation, the distinction was then made between fluctuating tumors, pulsating tumors, tumors that go up and down under the fingers "like a leather bottle full of oil," hanging tumors, and tumors that appear after cough. Moreover, the physician had to observe the temperature and consistency of the swellings, whether they softened after a certain period of time, whether they could be divided by the hand into a number of smaller tumors, whether they were mobile, and so on. Then their contents were noted: liquid, waxy, gum-like, or purulent? It was also important to find out whether a limiting membrane surrounded them. The tumor was then sometimes percussed. Examination of the rest of the body was not to be neglected. Eventually, surgical treatment with the knife, cautery, or a scalpel heated in the fire was carried out for most of the tumors with the exception of leprous tumors, aneurysms, and varicose veins, all of which the hand was not to touch. Aneurysms and some tumors such as breast swellings were treated with the fire drill.

I hope you have enjoyed our brief excursion into the pharaonic past. I would like to think you share my opinion that this past has a future at our hands as long as we continue to contribute to medical science those seemingly small entities that we derive, as did our ancestors before us, from our observations, experience, and technology-aided studies. Together, we shall be building more pyramids of medical knowledge to the benefit of mankind. Let us meet the challenge.

References

1. Breasted JH. The Edwin Smith Surgical Papyrus. Chicago: University of Chicago Press, 1930.
2. Ghalioungui P. The House of Life. Magic and Medical Science in Ancient Egypt. 1st ed. London: Hodder & Stoughton, 1973.
3. Nunn JF. Ancient Egyptian Medicine. London: British Museum Press, 1996.
4. Worth EJ. The Medical Skills of Ancient Egypt. rev. ed. Science History Publications, 1993.

Chapter 3

Ancient India

Raman C. Mahabir, Jochen Son Hing, Alda L. Tam and Alex D. Vastardis

Modern surgical practices, especially those of plastic surgery, have their origins in ancient Indian civilization. While Greece influenced medicine in the West, Arabic medicine was the authority in Europe before the 17th century. Since the Ayur Veda literature was translated into Arabic and Persian by the 11th century, it is logical to assume that the practices developed in the Indus Valley went not only East, as far as Japan, but also West, to influence medicine today.

To see how these procedures spread, look to Indian history where civilization has existed for at least 5000 years. The preAryan culture flourished in the Indus Valley from 2500 to 1500 BC at which time an Aryan people invaded. The conquerors adopted the already advanced system of public sanitation and brought with them the foundation for the subsequent religious and cultural developments of India. Centuries later, the Aryan Hindu people migrated east to countries that are now part of Southeast Asia: Burma, Thailand, Cambodia, Laos, Vietnam, and Indonesia, taking their knowledge with them.

The Hindus recorded this knowledge, as well as religious cultures and practices, in a series of books collectively called the Veda. The Atharva Veda, acknowledged as the earliest record of medical subjects in India, is filled with charms, spells, and incantations meant to ward off evil spirits, diseases, and enemies. Unlike many of its contemporary societies, the Indian religion and mysticism did permit a system of secular medicine that engaged in sound, rational processes, although not completely free of magical associations. The Ayur Veda, which translates as "knowledge of life," developed from the Atharva Veda and aimed to improve and prolong life. Many of the practices outlined in the Ayur Veda are still used today in India along with the teachings of Western Medicine and ancient traditional Indian medications and remedies are the topic of considerable research to determine their value to modern scientific medicine.

An examination of the writings reveals that surgery in India developed independent of Greek influence and that surgery held a position of honor, making it the subject of careful study. One of the five works of the Ayur Veda, the Susruta-samhita (the collection of the physician Susruta), is of particular interest in the history of medicine for its devotion to the art of surgery.

Susruta, with his discourse on surgery, is one of the most famous physicians in Hindu medicine. While there is uncertainty surrounding the exact dates of his life, he is credited with making an unequivocal contribution to the practice of medicine in his own time, as well as shaping some of the surgical practices of

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

modern medicine. Susruta collected and documented the experiences of older surgeons in order to describe and classify diseases and their management. Surgical procedures were classified into eight groups: incision, excision, scraping, puncturing, extraction, secreting fluid, suturing, and chemical surgery by means of alkali and cautery.

Operations for abscess drainage, amputations, cataract operations, tonsillectomy, neck tumor excision, lithotomy, obstetrical procedures, bowel obstructions, hemorrhoids, and anal fistulas were described in the Susruta-samhita long before they were ever adopted in Western medicine. A special chapter in the book is dedicated entirely to the pathology and treatment of fractures.

Perhaps the Hindu peoples' greatest contribution to medicine is their pioneering work in plastic surgery. Physical mutilation was a routine punishment for crime in Hindu society and, as a result, can be looked upon as a chief cause for the introduction of plastic surgery measures to repair the ear and nose. It is well documented that plastic surgery was practiced in India more than 2000 years ago. At that time, removal of the nose was the punishment for an adulterer. The art of rhinoplasty was practiced by many early Indian surgeons. Susrata on nasal reconstruction:

> *First the leaf of a creeper, long and broad enough to fully cover the whole of the severed of clipped part, should be gathered; and a patch of living flesh, equal in dimension to the receding leaf, should be sliced off [from down upward] from the region of the cheek and, after scarifying it with a knife, swiftly adhered to the severed nose. Then the cool-headed physician should steadily tie it up with a bandage decent to look at and perfectly suited to the end for which it has been employed. The physician should make sure that the adhesion of the severed parts has been fully effected and then insert two small pipes into the nostrils to facilitate respiration, and to prevent the adhesioned flesh from hanging down. After that, the adhesioned part should be dusted with [hemostatic] powders; and the nose should be enveloped in Karpasa cotton and several times sprinkled over with the refined oil of pure seasmum.*

Magical beliefs of the time held that piercing the ear lobe and enlarging the opening was a means of affording protection against misfortune. Ironically, this often led to rips through the lobe by a pulled earring. This provided a large volume of practice for the development of ear lobe reconstruction.

Susruta Describes an Otoplasty

> *A surgeon well versed in the knowledge of surgery should slice off a patch of living flesh from the cheek of a person so as to have on of its ends attached to its former seat [cheek]. Then the part, where the artificial ear lobe is to be made, should be slightly scarified [with a knife] and the living flesh, full of blood and sliced off as previously directed, should be adhesioned to it [so as to resemble a natural ear lobe in shape]. The flap should then be covered with honey and butter and bandaged with cotton and linen and dusted with the power of baking clay.*

Susruta goes on to describe how the ear lobe is to be shaped and gives instructions for post-operative management.

The essentials of the repair procedures described are basically the same as modern plastic surgery. From these two quotes, it is also apparent that the ancient Indians had knowledge of surgical instruments and dressings. A considerable section is devoted to the details of proper surgical instruments, some 125 total, including scissors, needles, lancets, catheters, tweezers, trochars, knives, forceps, specula, scalpels, saws, and syringes. These are often described for their likeness to the world at large. For example, two types of forceps were the "lion's jaw" and the "heron's bill." Four types of sutures (hemp, flax, bark fibre, and hair) were used, and three kinds of needles (round, triangular, and curved) were available. Also outlined are various types of bandages and dressings and the conditions for which they were and were not to be used.

Interestingly, this strength in surgery was not paralleled by strength in anatomy. This is evidenced by their belief that the heart, the seat of intellectual process, was shaped like an inverted lotus flower, closed during sleep and open during waking. Although religious laws forbidding cutting into a dead body might explain this, Susruta himself describes placing dead bodies in baskets and immersing them in the river to allow decomposition and subsequent internal visualization.

The Susruta-samhita is mainly a surgical compendium but also includes medicine, pathology, anatomy, biology, obstetrics, ophthalmology, hygiene, and psychology. The document contains descriptions of about 1,120 diseases. It also attempted to outline the philosophy of medical teaching: what sort of student should be selected, how he should be trained, the oath he should take, and the qualifications a physician should have before entering into practice. The oath in the Susruta-samhita has been noted to be strikingly similar to that of Hippocrates and this has led many scholars to compare other points of the Greek and Indian medical systems. The two systems shared many fundamental beliefs; such as the 3 stages of fever and that the body was composed of humors, whose derangement led to the development of disease.

Modern civilization does well to recognize the Greek contribution to medicine, but must never overlook or diminish contributions from ancient India.

References

1. Bender GA. Great Moments in Medicine. Detroit: Northwood Institute Press, 1966:40-49.
2. Margotta R. An Illustrated History of Medicine. Verona: Hamlyn Publishign Group, 1968:30-34.
3. Guthrie D. A History of Medicine. London: Thomas Nelson and Sons Ltd., 1945:32-34.
4. Castiglioni A. A History of Medicine. 2nd ed. New York: Alfred A. Knopf Inc., 1945:84-97.
5. Porter R. The Cambridge Illustrated History of Medicine. Cambridge: Cambridge University Press, 1996:203.

Chapter 4

Ancient Far East

Tarique Qayumi

Medicine in Ancient China has been traditionally noninvasive. According to Confucian teaching, the human body is sacred and therefore it cannot be dissected. The Chinese concentrated their healing practices into harmonizing the body, which led to a vast number of internal therapies for every kind of ailment. A combination of Confucianism and superiority of internal therapy led to limited surgical knowledge and practice.

Treatment in Chinese medicine was classified into five methods: cure the spirit, nourish the body, give medications, treat the whole body, and use acupuncture and moxibustion. The actual process of these treatments ranges from eating the right foods in the right seasons (nourishing the body) to controlling harmony in the body through needles (acupuncture). Surgery, however, is not one of the preferred means of treatment. In the Chinese medical canon, the Nei Ching, surgery is only touched upon twice: once as a last means when all other therapies fail, and another time concerning the treatment of ulcers: "The fairest treatment is to weigh and to consider careful removal, as well as cutting and scooping out exposed and spoiled particles." In fact, in the order of medical practitioners, the surgeons ranked only above the veterinarians, while the pharmacologist came first, the dietary physician second, and the family physician third.

There are, however, two well-known surgeon legends in Chinese history: Pien Ch'iao, who practiced in the second century B.C., and Hua T'o who practiced in 190 A.D. Pien Ch'iao used anesthesia to control pain in his patients, and also was said to have transplanted a heart. Hua T'o was also skillful in anesthesiology and operative techniques. Hua T'o was thought to have used a mixture of hashish or opium with wine to control pain in his patients. One of his famous surgeries was the treatment of the general Kuan Yü, who had been wounded in the arm. Legend has it that the general played chess while Hua T'o operated without anesthesia.

Hua T'o is also known for writing many books on surgery an anesthesia, but none of his books survived after his death. He was said to have performed many surgeries from laparotomy to trephination. Perhaps Hua T'o's only surgical technique that was used after his death was his method of castration. Originally meant as means of punishment, castration was a way for eunuchs to pledge allegiance to the monarch in order for them to advance their position in the courts. After castration, the eunuchs could not have a family and therefore devoted their entire lives to the throne.

In ancient Japan it was not until the 6th century that medical knowledge was imported from Mainland China. The Japanese made no advances in surgery of their own until the Kinso-i (wound surgeons) came about in the 14th century. The Kinso-i

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

were inactive soldiers who took on duties of military doctors. These trauma surgeons made a name for themselves for healing wounds on the battlefield.

In the Far East, the Chinese dominated medicine in ancient times. Surgery, however, never really flourished because of the Confucian teachings that the human body was sacred. The physicians in ancient China preferred to cure disease through noninvasive techniques and were so successful at these techniques that in time they believed that everything could be cured by harmonizing the body. Many of the same drugs that the ancient Chinese used are still in use today in modern medicine. Modern scientists are also revisiting acupuncture and other important Chinese cures in order to study their validity. There is no doubt that the ancient Chinese contributed greatly to medicine as a whole, excluding surgery because, according to themselves, they never had the need to experiment any further.

References

1. Ellis H. A History of Surgery. London, England. Greenwich Medical Media Limited, 2001.
2. Huard P, Wong M. Chinese Medicine. New York. McGraw-Hill Book Company, 1968.
3. Wu L. Past and Present Trends in the Medical History of China. Chinese Med J 53:313-322, 1938.

Chapter 5

Ancient Greece—Pergamum

Luis H. Toledo-Pereyra

Medical centers of today reflect needs and functions of complex societies that have scaled the pinnacles of technology and science. Yet medical centers of the past, like the one erected in Pergamon (in common English), still have much knowledge to offer us as modern practitioners.

Pergamon, now called Bergama and located in western Turkey, represented an ebullient cultural and business center in early Christian times. Pergamon, Ephesus, Antioch (in Turkey), and Carthage (in Tunisia) constituted a unique group of cities of more than 250,000 inhabitants. They were surpassed by Alexandria in Egypt with 700,000 people and Rome with nearly 500,000 citizens.[1] Athens, the uniquely developed city state, had a population of less than 200,000 at this point.

The life of antiquity was simpler, devoid of the overcrowded and redundant services we see today. Citizens attended to their functions with ease, and showed marked flexibility in their contributions to society. Democracy still stood in the shadows of monarchic and dictatorial rule. Medicine was undergoing a transformation from magic and occult principles to scientific concepts. Antiquity had Hippocrates, Erasistratus, and Galen, while modernity trusted Pasteur, Koch, and Lister to carry the torch of progress. Antiquity had temples to Asclepius as centers of healing, and modernity has built extraordinary architectural structures with a similar purpose, to take care of the unhealed.

In spite of the wide gulf separating ancient from contemporary medicine, there remain some strong similarities. Both medical systems have shared the same goals, to heal the insane; both have pursued specific formulations to generate cure, and both have attracted the best minds to engender healing and advance medicine. The greatest contribution of modern medicine is the increasing specialization of patient care. Of course, specialization can also be conceived as the worst nightmare, because of the extraordinary complexity and increased cost it entails. GrecoRoman medicine at the time of Galen and the Asclepius Center of Healing of Pergamon was based on Hippocratic medicine of natural cures and incubation. Modern medicine is based on specialized treatment, a medicine of new drug discoveries and scientific principles.

The Asclepius Center of Healing of Pergamon exemplifies the medical centers of antiquity.[2] Three other centers, Epidaurus, Ephesus, and Cos, were also recognized as the healing centers of the ancient world. Shrines to Asclepius attracted the sick. At the Pergamon Center of Healing, Galen exerted his incredible cures. Patients flocked from all over to be seen by the master healer.[3] Immediately upon arrival, the patient was purified, visited the temple, and then entered a period of incubation. At the treatment center or Telesphoreion, the treatments followed the

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

recommendations of a physician, in this case Galen, the renowned doctor of antiquity. After treatment, the patient would leave for recovery at home under ideal circumstances.

Great similarity is evident between ancient and contemporary medicine, not only in purpose but in sequence of events; patients come to the hospital, are attended by nurses, orders are written by a physician, and a period of observation is established before treatment begins. During this time, laboratory tests (not existent in ancient times) are obtained and the physician considers treatment. Thereafter, the patient is discharged for recovery at home. In contrast to the patients visiting the Asclepius Temple of Pergamon, patients of today remain hospitalized for further intensive or invasive therapies or surgical intervention if required. In agreement with the present way of studying disease, staff, residents, and students visit the library for further enhancement of knowledge; in antiquity a well-funded library at Pergamon—second only to Alexandria in the Western world—was at the disposition of knowledge seekers and studious physicians.

The Asclepius Medical Center of Pergamon—in addition to the other medical centers of the Greek world—should be considered the origin of current medical centers and clearly represents the most sophisticated medical centers of antiquity.

References

1. Conrad LL, Neve M, Nutton V et al. The Western Medical Tradition: 800 BC to AD 1800. Cambridge: Cambridge University Press, 1995:33-38.
2. Pergamon. Istanbul: Rehber, 2001:79-87.
3. Magner LN. A History of Medicine. New York: Marcel Dekker, 1992: 74-76.

Chapter 6

Turkey

Atilla Soren, Filiz Aslan, Mükerrem Cete and Iskender Sayek

Located on two peninsulas, Anatolia and Thrace, Turkey has been heir to many civilizations and cultures—the original Central Asian Turkish culture, the Arabic and Persian Islamic culture, ancient Anatolian culture of the earlier periods, and European cultures before and after the foundation of the Turkish Republic in 1923.[1] With a population of 60 million Turkey is one of the youngest and largest countries in Europe and the Middle East.

Archaeological findings including surgical instruments made of copper and bronze inform us about the surgical work in ancient Anatolian civilizations. If they are compared with the findings of Asia, Mesopotamia, and Pompeii, similarities can be observed and it can be argued that the ancient Greek and Roman medicine and surgery had been influenced by the methods and instruments of ancient Mesopotamia, Anatolia, and Asia. There is also similarity between these findings and the modern surgical instruments of our time.[2]

This work will summarize the historical milestones of the history of surgery in Turkey and the evolution of the modern practice of surgery. The evolution of medicine in Anatolia can be studied in two eras: the first is the "eastern" and the second is the "western" era.[3,4] Others have studied this evolution in three periods, namely the (a) preIslamic, (b) post-Islamic, and (c) western periods. The historical distinction is mainly related to the Ottoman period. Modernization started during the late Ottoman period (1839-1918) and assumed a significant momentum after the foundation of the republic.[3,5]

Ancient Turkish medicine (Central Asian) was significantly influenced by Chinese and Indian medicine.[6] Early Islamic medicine had its roots in ancient Mesopotamian, Central Asian, Egyptian, Indian, and Roman practices among which Greek medicine particularly stands out.[6,7]

The Seljuk and the early Ottoman periods (12-13th centuries) were characterized by the influence of Islamic culture and medicine. This era can also be described as one which accepted the concepts of Hippocratic medicine, using the scripts translated from ancient Greek and Roman classics into the native language.[3] The Seljuks are well known in history as people who constructed hospitals and started medical education.[7,8] Ottoman medicine was based on the Seljuk and other Islamic medical literature and practice.

In the early years of the Ottoman Empire there were health centers called "Darussifa" where therapeutic medicine was practiced. Haci Pasha (1334-1424) was well known for the treatment of hemorrhoids. Ahi Celebi during the same century had written a book on the management of renal stones.[7]

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

The most famous surgeon of the Ottoman history is Serafeddin Sabuncuoglu (1386-1470). He studied medicine at Amasya, a city in central Anatolia where he developed numerous surgical techniques. He published three important books[7] one of which, namely "Cerrahiyet-ul Haniye" (Imperial Surgery) was essentially an atlas of surgery.[9] This was the first published atlas of surgery with miniature illustrations demonstrating the management of gynecomastia, mammoplasty, nasal fractures, drainage of empyema, intubation of the pharynx and upper esophagus, removal of foreign bodies from the esophagus, and cauterization.[7,9-12] This atlas was revolutionary in the Islamic world because it included pictures of both men and women, and included even scenes of birthing.[9]

A concept of "surgeon in-chief" was established in command of the "physician in-chief" who was responsible from all health care, both scientific and administrative in the 17th century.[6,8] The surgeons were also responsible for treating soldiers wounded in wars.[7]

The first influence of European surgery is observed in the 17th century. Some Latin books had been translated into the Ottoman language. There were some local physicians such as Semseddin Itaki of Sirvan and Emir Celebi who were interested in anatomy and illustrated their translations with miniature drawings in various books.[7]

With the efforts of modernizing the army Sultan Mahmud II established the first medical and surgical schools in Istanbul (Tiphane ve Cerrahhane-i Amire) on March 14, 1827. The aim was to support the army with the necessary medical and surgical staff. This is now considered as the first step of modern medical education in Ottoman history[7,8] In 1839 these schools were reorganized as a single medical faculty.[8]

Closer relationship of the Ottomans with European medicine began in the early 19th century. Sade de Calliere, a French surgeon was intended to give lectures from St. Come and Damien Medical School which educated surgeons exclusively.[8,13] Ismail Pasha (1807-1880) the physician and surgeon in chief went to Paris for further surgical education.[7] Dr. Charles Ambroise Bernard (1808-1844), during the same period, was the first physician to study cadavers in this country. Bernard also taught modern pathology and anatomy. After 1842 he started performing autopsies.[8] His student Dr. Spitzer continued this practice. Constantine Karateodori, an Ottoman-Greek surgeon, took over lecturing on surgery from Dr. Bernard in 1842 and continued to teach until 1879.[3]

Before this era surgery, as well as medicine, was mostly practiced by Greeks, Armenians, and Jews of the Empire, plausibly because of Muslim inhibitions about innovative practices in all fields of life. The surgical procedures in that period were mostly amputative surgery and wound care. In 1875 some students were selected by the state and sent to Europe to learn modern surgery.[13] This is an important milestone in the development of modern and scientific surgery in Turkey. This progress was closely related to the use of anesthesia, application of asepsis and antisepsis in daily surgical practice, and better understanding of homeostasis.

Dr. Cemil Topuzlu (1866-1958) who was a graduate of Istanbul University Medical School had his formal surgical training in Paris (1887-1890) at Laenec and St. Louis Hospitals under the supervision of the famous Dr. Pean.[13,14] Upon his return to Istanbul he was appointed as surgeon in chief to one of the major hospitals where he started to apply the principles of asepsis-antisepsis in daily practice.[13,14] His leadership created an "university reform" nationwide in that era which is an important milestone in the history of medical education. His contribution to scientific surgery was enormous for that period. He was the first to report the results of 758 major surgical procedures performed from 1893 to 1897 with a mortality of 3.6%. In 1897 he reported primary repair of the axillary artery secondary to injury during extirpation of breast cancer invading the artery in two cases during the 12th International Medical Congress in Moscow well before Alexis Carrel performed his vascular anastomosis in 1904 and was awarded the Novel Prize in 1912.[16] In 1904 he further reported repair of the external iliac artery. He was the first surgeon to perform procedures with sacral anal construction and thyroidecotomy. He also reported 5000 cases in which chloroform anesthesia was used and one patient who required open heart massage after cardiac arrest during surgery in 1903.[14]

After the foundation of the republic in 1923 surgery started to progress and develop toward contemporary standards. In the 1930s German Jewish Professors came to Turkey while escaping from the Nazis. Professor Rudolph Nissen, a German surgeon from Berlin and one of the most prominent surgeons of Billroth's School, taught and practiced surgery in the Istanbul University School of Medicine from 1933 to 1939 and acted as the Director of Surgery. His stay in Istanbul had a significant impact on the development of modern surgery in Turkey.[15] Dr. Eduard Melchior was another surgeon who came to Turkey in 1936 and practiced surgery in the Ankara Numune Hospital. Later in 1945 he became the Director of ll. Surgical Unit at Ankara University Medical School, the first medical school established after the foundation of the republic. He practiced surgery in Ankara until 1945.[15]

By the 1960s the influence of American surgery became evident when a significant number of American trained surgeons returned to Turkey, to the newly established Hacettepe Medical School which began educating surgeons in the Halstedian school under the leadership of Dr. Hüsnü Göksel.[3] Modern hospital management and integrated medical education were introduced to the practice of medicine in Turkey.[4] After the 1980s new medical schools flourished all over the country, with teaching hospitals of the Ministry of Health and Social Security.

Surgical Training in Turkey

Undergraduate medical education is a six-year program after which one may be qualified for post-graduate training. Each year between 4000 and 4500 doctors graduate from medical schools. The graduates are screened through a highly competitive central examination for a specialty program of their choice for placement in a post-graduate program. Approximately 2000 positions are available for post-graduate training every year. The Ministry of Health coordinates post-graduate education.

Surgical training is given in University Hospitals, hospitals of the Ministry of Health and Social Security. Currently post-graduate training in surgery is offered in 32 University Hospitals, 13 Ministry of Health Hospitals, and 6 Social Security Hospitals. Each training program has 15 to 200 beds, depending on the size and status of the institution. Every year 120 to 150 positions become available in general surgery. The duration of the training program is currently five years in most universities and four years in other hospitals. There is a consensus to standardize the programs for the duration of five years.

After completion of the program, the trainees must take an exam in their institution to become specialists. In recent years with the prospect of entering the European Union, specialty boards are being instituted. The Turkish Surgical Society decided to hold the first National Surgical Board examination in 2000.

At present, subspecialty training is offered in gastrointestinal surgery, oncological surgery, cardiothoracic and vascular surgery, pediatric surgery and plastic and reconstructive surgery after completion of the general surgical training. These training programs are for two years. Programs other than gastrointestinal or oncological surgery can be taken as separate programs besides orthopedic and urological surgery.

There are about 3000 practicing surgeons in Turkey performing all kinds of major surgical procedures where they rotate including transplantation teaching in county and private hospitals where the facilities are adequate to perform all major surgical procedures. Based on a rich heritage of historic literature, surgery in Turkey continues to flourish in cooperation with global practices.

References

1. Turan S. Türk Kültür Tarihi, Türk Kültüründen Türkiye Kültürüne ve Everensellige. Ankara: Bilgi Yayinevi, 1990.
2. Yalav E. Cerrah ve Aleteleri. A.Ü.T.F. Mecumasi, cilt 15 sayi 6, 1972; 1479-1500.
3. Kadioglu S. Türkiye'de Cerrahi Devrim. Ankara: Ankara Üniversitesi Saglik Bilimleri Enstitüsü Deontoloji Anabilim Dali, Doktora Tezi, 1997.
4. Örs Y. 'Süregeleni Degistirmede Cerrahi-Bir Cerrah' Bes Ögretim Üyesiyle Uzmanlik Çalismasi. Ankara: Yayimlanmamis Tez, 1973.
5. Örs Y. Islam Hekimligi, Selçuklu-Osmanli Hekimligi. A.Ü.T.F. Mecmausi 1975; 28:391-406
6. Eren N. Çaglar Boyunca Toplum, Saglik ve Insan. Ankara: SOMGÜR Yayinlari, 1996.
7. Demirhan A. Kisa tip Tarihi. Bursa: Bursa Üniversitesi Basimevi, 1982.
8. Sehsuvaroglu B, Demirhan AE, Güressever GC. Türk Tip Tarihi. Bursa: Uludag Üniversitesi, 1984.
9. Uzel I. Serefeddin Sabuncuoglu, Cerrahiyyetü'l-Haniyye. Ankara: Atatürk Kültür Dil ve Tarih Yüksek Kurumu türk Tarih Kurumu Yayinlari, III. Dizi, Sa 1992; 15a.
10. Dogan T. Plastic surgery techniques in the fifteenth century by Serafeddin Sabuncuoglu. Plast Reconstr Surg 1997; 63:1775-1779.
11. Batirel HF, Yüksel M. Thoracic surgery techniques of Serefeddin Sabuncuoglu in the fifteenth century. Ann Thorac Surg 1997; 63:575-577.
12. Büyükünal C, Sari N. Serafeddin Sabuncuoglu, the author of the earliest pediatric surgical atlas: Cerrahiye-I Ilhaniye. J Pediatr Surg 1991; 26:1148-1151.
13. Unat EK. Dünya;de ve Türkiye'de 1850 yilindan Sonra Tip Dallarindaki Ilerlemelerin Tarihi. Istanbul: Cerrahpasa Tip Fakültesi Vakfi Yayinlari, 1988.
14. Topuzlu C. 80 Yillik Hatiralarim. Istanbul: Istanbul Üniversitesi Cerrahpasa Tip Fakültesi Yayinlari, 1982.
15. Onat D. Cerrahinin Tarihçesi. Temel Cerrahi, Ankara: Günes Kitabevi Yayini, cilt I, 1991; 3-12.
16. Edwards WS. Alexis Carrel's contributions to thoracic surgery. Ann Thorac Surg 1983; 35:111-114.

Chapter 7

Ancient Mexico

Patricio Santillan-Doherty

Ancient Mexican culture is full of contrasts and, unfortunately, best remembered by accounts of endless Aztec wars, human sacrifice, and ritual cannibalism. While much academic debate has been produced around the accuracy of human sacrificial descriptions, the mainstream indicates that it was practiced as part of a religious renovation.[1] Two aspects of this relate to us dwellers of the modern medical age. The first has to do with surgical technical skills required to obtain a beating organ to offer the gods; the second is the meaning of it all. Since these offerings were done during critical moments which coincided with cyclic changes in nature, the ultimate purpose was that of restoring the dangerously maladjusted "cosmic energy." Not at all very different from the purposes we pursue today with organ transplantation; although the targets are different (society well-being versus individual health), the outcome remains similar.

This perhaps could be the first medical lesson obtained from ancient Mexican culture: societal health. On the other hand, one cannot help thinking of heart procurement and transplantation as a modern offering to restore the health of individual members within our own society. Is there a difference? I do not pretend to discuss the matter, but I do wish to describe other lesser-known aspects of medicine in ancient Mexico. Aspects, which perhaps are, not motive enough for a bestseller or a major motion picture, but nevertheless were an important part of the daily life of ancient Mexicans.

Precolumbian Mexico

In order to get into perspective, one must remember some important dates regarding ancient Mexican civilization. The beginning of agriculture has been dated back to 5000 BC. The Olmec culture in the south of Mexico unified Mesoamerica around 800 BC, the Teotihuacan Empire was established between 300-600 AD and the decline of the Mayan civilization around 900 AD. The official foundation of Tenochtitlan (Mexico City) was the year 1325 and the fall of the Aztec Empire under the rule of Spanish "conquistadors" was barely two centuries later in 1521.

As mentioned above, religion played an important part in the Aztec culture. It also played an important part in the development of their imperialism, thanks to which they controlled most of Mesoamerica at the time of the arrival of Columbus. It was a polytheistic religion and among the many gods, Huitzilo-pochtli was the most important. He was the war-sun god who died every evening to be born anew the following morning after conquering darkness with a fight and letting the light come to illuminate the world. The mother of gods, Tlazolteotl (also referred to as Teteoinam or Tod), was the goddess of medicine and medicinal herbs, and

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

was worshipped by physicians. She was also the cleanser of evils, the lady of carnal love, and the great bearer (another referral to the cyclic renewal of Aztec life).

Most of our information concerning PreColumbian medicine is obtained from the writings of Spanish chroniclers, although ceramics, weapons, instruments, mummies, and some native writings occasionally serve as sources. The Aztecs either left no direct records of their medicine, or these were destroyed during the conquest. We therefore must rely mainly on documents written afterwards. The most important ones are:[2]

1. The works of Fray Bernardino de Sahagun (1499-1590). His Primeros Memoriales from the Madrid Codices; and a revised document known as the Florentine Codex from which his General History of the Things from New Spain was written.
2. The Libellus Medicinalibus Indorum Herbis, written initially in Nahuatl (Aztec language), by the native Martin de la Cruz and later on translated to Latin by Juan Badiano and known as the Martin-Badiano Codex (1522); it contains a large description of the therapeutic properties of plants.
3. The Natural History of the New Spain and the Nova Plantarum, Animalium etMineralium Mexicanorum Historia written by Francisco Hernandez, the first chief physician appointed to the West Indies by King Phillip II of Spain, where he tried to fit Indian medicine into the paradigms of Galen.

Also important are the series of native incantations compiled by Hernando Ruiz de Alarcon as well as the Vocabulario, a Nahuatl-Spanish dictionary by Alfonso de Molina.

By reviewing at these sources, one can recognize that Aztec medicine was not different from that practiced in the Old World, if not even better, because of the extensive use of medicinal herbs. The Spanish conqueror Hernan Cortes recognized this and even went to the extent of asking King Phillip II not to send physicians from Spain because the native ones were very skilled and knowledgeable.[3]

Medicine In Aztec Culture

Aztecs possessed a mixture of naturalistic and super naturalistic medicine common to other ancient cultures. Their knowledge of anatomy was important, although limited to experience acquired in the kitchen, in war, and at the sacrificial altar; knowledge of physiology was very scarce, and they considered the heart to be the most important organ of the body believing it to be the source of feeling and thought.

A concept of particular interest is that of the tonalli. This was that part of the personality of the individual which related to his fortune, luck, and destiny. At the same time, the word conveys a meaning of light, warmth, sun, and day. It was a kind of life force received by each individual at birth and was essential for vigor, growth, and valor. Tonalli could be lost, often by divine punishment, and as consequence, the patient would become the victim of all kinds of diseases and would eventually die. It has been identified with the western concept of soul. Anatomically located in the head, when it left the body because of divine wrath, cutting of the hair, sexual transgressions or fright it had to be restored; loss was believed to create a space in the head and this in turn would produce a cranial depression. If a young infant had a depression of the fontanel, this was corrected by hanging the child upside down and pushing the palate up with force.[4]

There were two types of curers; the physicians (tepatiani or ticitl), who used naturalistic paradigms, and those who used horoscopes and other super naturalistic means (the nahualli, who can still be found helping the sick in remote parts of the country). Women were apparently admitted to the practice of medicine on equal footing with men. According to Sahagun, the ticitl "...was a curer of people, a restorer, a provider of health... the good physician is a diagnostician, a knower of herbs, of stones, of trees, of roots. He has results of examinations, experience, prudence. He is moderate in his acts. He provides health, restores people, provides them splints, sets bones for them, envelopes them in ashes.... The bad physician is a fraud, halfhearted worker, a killer with his medicines, a giver of overdoses, an increaser of sickness; one who endangers others, who worsens sickness...."

One can see that physicians not only gave medicines or herbs but performed several surgical procedures with great expediency and expertise; they treated fractures and performed surgical procedures to drain abscesses and reconstruct wounds. They would use plasters of the roots from the acocotli and nopal cactus wrapped around the fractured limb with cloth and splintered on four sides with wood fastened together with cords. Sahagun described the drainage of abscesses, and the suturing of wounds with fine cactus or porcupine needles and sutures made of hair or vegetable fibers like those obtained from the maguey plant. Pain control was obtained by using concoctions made with peyote, a member of the cactus family, which according to Sahagun "...gave them courage to fight and made them not feel any hunger or thirst...."

Diego Rivera and Mexican Medicine

Nobody has captured the significance of ancient Mexican medicine better than muralist Diego Rivera. Diego was, before all, a Mexican. In spite of having lived in France, befriending Picasso and becoming part of the cubist movement, his nationalism floated back when he returned to Mexico and embarked in the muralist movement with other Mexican painters such as Orozco and Siqueiros.[5,6]

Diego was influenced by the medical sciences since his years in France. In 1920, he painted The Surgical Operation, influenced by the invitation of French surgeon Elie Faure to view an operation. This scene was reproduced in his first commission for the Ministry of Education murals in 1924.Best known to the world is the mural painted for Mexico City's National Institute of Cardiology in 1943; the History of Cardiology was used as the undercover for the fourth edition of J. Willis Hurst's textbook "The Heart, Arteries and Great Vessels" (1978).

But it is the mural he painted between 1953-54 for the just opened Hospital de la Raza that best depicts and does homage to PreColumbian medicine. The mural, titled History of Medicine in Mexico: The People in Demand of Health, is a 120 m^2 fresco completed with glassed mosaics. The composition of this mural depicts a central vertical axis representing the dominant figure of the goddess Tlazolteotl (who, as mentioned above, was the lady of life, carnal love, and medicine); on both of her sides, Diego splendidly painted ancient and modern medicine (right and left sides of the mural respectively). On the central part, right under the goddess Tlazolteotl, Diego painted several medicinal plants, based on a very precise description in the Martin-Badiano Codex.

Of the whole mural, the section dedicated to ancient medicine is the most richly composed. Diego interrelated multiple scenes that describe medical knowledge of that time. This section is marked by the goddess Tlazolteotl on the left, the Tree of Life on the right and a panoramic view of Tenochtitlan at the top, and it is richly colored.

On the opposite section of the mural, marked by a square reticulum, which originates from a tree giving heart like fruits, are scenes depicting modern aspects of medicine, from vaccination to radiation treatment with a cobalt gun. One cannot help feeling the coldness with which Diego saw modern medicine by using red bluish tones and marking every different scene with the square like reticula, in comparison with the warmth and tenderness, which he attributed to the scenes from ancient medicine. Diego recognized the value of modern medicine, but the disadvantages of its technification did not escape him at all. This can best be felt by comparing the birth scene from the ancient medicine section with the cesarean delivery viewed on the opposite side. On the ancient section, Diego painted the scene with the mother being carefully cared by two women and the newborn received by the midwife-physician who is lovingly singing to the baby. On the modern side, one can see the surgeon and his helpers performing their work but the facemasks on them and the colors used by Diego give a certain coldness to the whole scene.

It is the scenes from ancient medicine where Diego showed his knowledge of the sources we have today about medical practice by the Aztecs. Apart from the birth scene described above, other important scenes deserve to be outlined. Immediately above (the birth scene), there is a surgeon suturing a thoracic wound in a patient asleep under the effects of peyote; he is being assisted by a woman who holds a set of nopal and porcupine needles as well as sutures for the surgeon to accomplish his goal. Right on top of the surgeon, one can observe two female physicians holding an infant upside down, trying to reduce an anterior fontanel depression in order to restore his tonalli (a reminder to the importance of the tonalli in Aztec culture; see above). To the right of this scene, there is yet another surgeon performing a craniotomy; although there is archeological evidence of these procedures in ancient cultures, it is interesting that Diego should depict this as an Aztec scene when the instrument being used by the surgeon is a tumi from the Inca culture in Peru. (Perhaps Diego was fascinated by the fact that ancient American cultures performed such procedures, or he was simply attracted to the beautiful form of the tumi knife). Two scenes to the left of the craneotomy, there is a physician stabilizing and splinting a right ante-brachial fracture, and immediately above, a woman applying an enema. Other scenes include a dental extraction, and a physician presenting a patient with a concoction made from magnolia, which was used to treat heart ailments.

All the scenes painted by Diego have been described in sources dating to the time of the Aztecs and mentioned at the beginning of this brief writing. Diego Rivera made a perfect summary of ancient Mexican medicine not only by showing us the different procedures the ticitl would perform, but also by transmitting the atmosphere of those times, and the care with which those procedures were performed. Finally, he masterfully conveyed to us the eternal theme that weighs down upon all men and which did not escape the Aztec people: the universal duality of health and disease, of life and death.

References

1. Gonzalez-Torres Y. El Sacrificio Humano Entre los Mexicas. Institute Nacional de Antropologia e Historia. Mexico: Fondo de Cultura Economica, 1985.
2. Prioreschi P. A History of Medicine. Primitive and Ancient Medicine. Lewiston, NY: The Edwin Mellen Press, 1991:1:537-595.
3. Flores y Troncoso FA. Historia de la Medicina en Mexico. Mexico: Instituto Mexicano del Seguro Social, 1982.
4. Lopez-Austin A. The Human Body and Ideology Concepts of the Ancient Nahuas. Salt Lake City: University of Utah Press, 1988:38-42.
5. Diego Rivera. Mural Painting. Mexico: Fondo Editorial de la Plastica Mexicana, 1989.
6. Rabell J, Chavez V, Gomez A et al. Diego Rivera y la Cirugia. Cirujano General (Mex) 1994; 16:293-295.

Chapter 8

Early America

Luis H. Toledo-Pereyra and Suzanne E. Toledo Zimmerer

In this historical essay we highlight three of the primary factors influencing early American medicine: the spirituality of North American Indians, the diseases that the British brought with them to America, and the emerging scientific approach that the British began to embrace.

North American Indians were content with their way of life before the Europeans—mostly British—insinuated themselves into the northeastern part of the American continent. As the British arrived, North American Indians began to demonstrate increasing difficulty with their presence, to the point of being demoralized and unable to successfully defend their soil. Unfortunately, the first American Indians who sparsely populated the North American continent did not preserve writings or vestiges that could show their way they contributed to their land, their health, or their form of medicine. However, through oral traditions, we now believe that American Indians had good health, and the frequent infectious diseases that we still combat in the 21st century were not present on North American soil until the Europeans arrived.[1-7] The first British settlers usurped the North American Indians with a killer combination of force and new disease. Diseases were the best soldiers that any nation could have possessed. Diseases helped the British conquer the North American Indians.

Near Chesapeake Bay (Maryland), British colonists founded Jamestown (Virginia) in 1607, the first permanent British settlement in North America. In the ensuing century, colonists continued to flock from the European continent to America until 1733 when the last permanent colony was settled (Georgia). Nearly one hundred years before the first British settlement, the Spaniards, under the leadership of Hernan Cortes, in 1521, had already entered another portion of the American continent and had finally defeated the Aztecs, taking over the city of Tenochtitlan (today Mexico City).Ours, by choice, is the description of Anglo-America as it relates to the development of medicine in this country.

The Indians who occupied what is now the United States of America, included a large number of tribes with various means of providing sustenance for themselves. The Indians of North America (including part of Mexico) lived in the following geographical or cultural areas: (1) the Far North, which included the Algonquin, Chippewa, Ottawa, and other tribes; (2) the Eastern Woodlands, which included the Chippewa, Iroquois, Menominee, and other tribes; (3) the Plains, which included the Cheyenne, Comanche, Sioux, and other tribes; (4) the Northwest Coast, which included the Chinook, Quileute, Tsimshian, and other tribes; (5) the California Intermountain area, which included the Hupa, Karok, Mohave, Pomo, Ute, and other tribes; and (6) the Southwest area, which included the Apache, Navajo, Papago,

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Pima, Pueblo (Acoma, Hopi, Taos, etc.), Yaqui, and other tribes. This extraordinary variety of Indian tribes presented to North America a common approach to life and disease with certain regional differences. The understanding and care of diseased individuals also varied with the specific tribe in question, with some tribes being more advanced than others.

Before 1607, North American Indians did not have the significant diseases that were facing Europeans. Great epidemic and endemic diseases that had attacked Europeans for some time were unknown to Indians living in North America. Indians had no particular sanitary problems, and because of their eating habits and outdoor activities, few maladies affected them. Their main medical complaints originated from trauma, digestive disorders, and rheumatism. According to European observers, North American Indians had good stature and healthy bodies.[1-3]

To combat the diseases that the first British colonists brought to America, Indian medicine integrated spiritual and religious principles. Deviant behavior could aggravate the sleeping Great Spirit, so Indians needed to be conscious of all the steps required to prevent deflections from accepted moral or societal standards. The medicine man, or the shaman, was the religious leader who was responsible for communicating with the reigning god on behalf of the patient and his or her diseases. The medicine man had sole responsibility for healing.[1-4] No one else could take his position of benefactor and selected physician. When a disease would occur, the medicine man would need to plead with the spirit causing the problem. In handling the altered spirit, the medicine man would utilize dances, chants, incantations, medicine bags, amulets, and whatever else was necessary to secure the pardon of the offended spirit. Treatments included herbs, concoctions, sucking, sprinkling, and other remedies.[1-4] On other occasions, the medicine man would have to ask for support from friendly spirits, who, in any given case, would intervene to upset the spirit in his quest for normality.

Although North American Indian medicine relied on spiritual healing, a great deal of its practice depended on the use of herbs or botanicals. They were prepared according to their traditions; the Indians used boiling water and other cooking maneuvers, then administered them orally or rectally. The amounts would be large and the effect would often be emetic. The use of these various treatments would be, in any event, mystical and empirical.[1-4]

North American Indians were successful in dealing with trauma, including fractures, dislocations, wounds, and control of hemorrhage. They knew how to make splints for fractures or dislocations, to use bird down, moss, and other substances to stop bleeding, and to clean wounds with water and other herbal preparations.[2] They were sophisticated in giving excellent primary care to patients with these problems. The treatment of pain was another area of their dedicated attention. According to John Duffy, foremost professor of history at Maryland and Louisiana, the Indians relied on sweat baths, warm poultices, massage, and aromatic fumigation for the control of various pains.[1,2] Indian medicine in North America, then, was a religious adventure with some practical approaches without regard for science or experimentation.

The European medicine that came to America also had no regard for critical experimentation in general, but paid attention to practical details and, occasionally, had a religious approach. At the time that the Europeans (and, in this case, the British) began to settle in North America, their medicine was less acceptable than the medicine practiced by many American Indian tribes.[4-7] In fact, there was no

European systematic therapeutic approach, and the available medications for well-proven treatment were almost nonexistent. European medicine was just beginning to incorporate some science to their practice. They began to define the most important ingredients of successful treatments. But, despite their dedicated effort, scientists and physicians would not find effective treatments for years, even centuries. Under these circumstances, patience and faith were the most important virtues that patients needed to pursue.

At the beginning of the 17th century, North American Indian medicine was appropriate for the care of the suffering Indian, and it was not too distant, in essence, from the best European medical practices. The problem in years to come would be that Indian medicine would remain stagnant while European and, later on, North American medicine would grow with science and logical understanding. This would eventually constitute the rational approach to diagnoses and treatment, the foundations of the Hippocratic method. Other differences between orthodox North American medicine and the traditional Indian medicine would be the presence of empiricism versus no empiricism, the existence of rationalism versus spiritualism, and the lofty consideration of practical versus spiritual. Although it did not fully occur for hundreds of years, the colonists were on the path of needing to create knowledge and establishing a rational approach to the practice of medicine.[4-7]

The arrival of the British was painful in more than one way. The British brought with them several infectious diseases not recognized in America up to that time. These diseases decimated an incredibly large number of Indians. Smallpox, measles, tuberculosis, scarlet fever, diphtheria, typhus, venereal diseases, and malaria were among the long list of diseases infecting the Indians.[1-7] Smallpox was the most aggressive and devastating. Millions of Indians died in the northern, central, and southern regions of America as a consequence of the extraordinary infective capacity of this disease. The dissemination of the microorganisms producing the infection was rapid and often immoral, and no therapeutic armamentarium was or would be available until the 20th century.

It is a sad irony that those who established roots on the future United States of America—mainly the British—were the first ones to use germ warfare in the wars against the Indians. Biological weapons in the form of smallpox began their emergence in the Pontiac's Rebellion from 1763 to 1764. General Amherst had suggested that Colonel Bouquet distribute blankets filled with smallpox to the Indians. The disease was widely distributed to the Indian camps, and death and devastation subsequently developed.[1,2]

The invasion of North America by the British and their diseases was devastating to the well-fed and healthy nation of Indians, particularly when one realizes the low incidence of medical pathology in earlier times. Indians had no immune protective system for European infectious diseases since they had never been exposed to these diseases. Thus, the Indian struggle remained centered around tolerance and survival. This was a fight that would continue for years—a fight of white and red, conquest and humiliation, control and imposition, a fight that would remain alive in the annals of European and American history for centuries.

Who were the British that appeared in Jamestown in 1607, and what medical knowledge did they bring to the North American Indian nation? One hundred British colonists sent out by the London Company took over the untamed waters of the Atlantic under the stewardship of Captain John Smith. There were no physicians aboard except two "chirurgeons," Will Wilkinson, a barber-surgeon, and

Thomas Wotton, a gentleman surgeon. The colonists stopped in Virginia after suffering strenuous circumstances of a long and dangerous voyage. Captain Smith praised Wotton for his services, including services that Smith required personally. The next several years in Wotton's life remain unclear and undocumented. In 1608, during Smith's second expedition, Dr. Walter Russell was the first physician to reach English America. Post Ginnat and Anthony Bagnall were two chirurgeons who accompanied Russell. Smith himself had a wide experience as a chirurgeon and physician through his multiple exposures to disease and injury. He had made unique cures while in North America. In 1609, however, he received a severe burn that forced him to return to England because, according to him, there were no other chirurgeons in the fort. He did not return to America thereafter.[6-8]

A number of distinguished English physicians were interested in the colonization of Virginia or had a membership in the London Company. These interested physicians included Dr. Theodore Gulstone, Oxford graduate; Dr. Peter Turner, physician to Walter Raleigh; Dr. Leonard Poe, one of the king's doctors; and Dr. John Woodall, author of the Chirurgeon's Mate, who was concerned about the lack of milk in the colony and wanted to send cattle to it. Other members of the London Company had expressed serious concerns for the affairs of the new world.[6] It is important to mention that 4 years before 1607,Henry Keaton was the first English surgeon to land on the North American continent. He accompanied the fleet of Captain Bartholomew Gilbert, and while he was in the Chesapeake Bay, an Indian ambush terminated his life. Therefore, he was also the first English physician to perish while colonizing the new country and a hero to remember in English American history.

In 1610, Lord Delaware visited Virginia. On this visit, Lord Delaware brought Dr. Lawrence Bohun, who was one of the most respected surgeons and physicians in the Netherlands. Americans praised Bohun for his extraordinary medical services. Furthermore, he experimented with botanical remedies such as the uses of sassafras and other plants common in Jamestown. He obtained great cures with medicinal plants, particularly for those problems associated with fevers and general malaise. Dr. Bohun carried out a number of experiments with the various plants he encountered. He found good remedies for wound healing, dysentery, and the balance of the humors. Around 1611, his visit came to an end when Lord Delaware requested his company in the West Indies to obtain citrus fruits, the only remedy for the lord's scurvy disease. His whereabouts after this trip remain uncertain. In 1620 the colony of Delaware named him Physician General. That same year, unfortunately, a shot fired from a Spanish enemy vessel in the middle of the West Indies Sea mortally wounded Dr. Bohun.[6,7]

The unexpected death of Dr. Bohun further stimulated the interest of the London Company in sending well-trained physicians to the Virginia settlement.[6] Dr. Gulstone recommended Dr. John Potts, well experienced in the art and practice of surgery and medicine. He arrived in 1621 and stayed in the colony all of his life; he died around 1642. In addition, Dr. Potts had an extraordinary apprentice, Richard Townsend, who excelled in medicine, surgery, social, and political affairs.

In summary, a number of physicians and chirurgeons who came and left the colony had a minimal therapeutic medical arsenal. They brought from England some theoretical knowledge, few practical considerations, and the intention to improve their unsophisticated methods. Medical science, in a systematic way, was absent in the colonies for at least the first century of colonization. In general, colonial governors, clerics, and self-educated physicians routinely integrated health caregivers. Few had a formal education in well-respected European medical schools, which were rare at the time. Clearly, the state of medicine in the new colony was not the best, and even though North American Indians and Europeans unintentionally helped each other in the care of patients, the evidence of progress was not present in the pioneering days of the colony.

References

1. Duffy J. The Healers: A History of American Medicine. Urbana: University of Illinois Press, 1969.
2. Duffy J. Medicine and medical practices among aboriginal American Indians. In: Marti-Ibanez F, ed. History of American Medicine. New York: MD Publications, 1958.
3. Burke JG. Apache Medicine-Men. New York: Dover, 1993.
4. Hamerschlag CA. The Dancing Healers. New York: Harper Collins, 1988.
5. Reiss O. Medicine in Colonial America. Lanham MD: University Press of America, 2000.
6. Blanton WB. Medicine in Virginia in the Seventeenth Century. Richmond, VA: William Byrd Press, 1930.
7. Gordon MB. Aesculapius Comes to the Colonies. NJ: Vetnor, 1949.
8. Toledo-Pereyra LH. Origins of surgery in British Colonial America. J Invest Surg 2003; 16:3

Section II. Surgery:
Old Masters, Pioneers and Others

Chapter 9

Galen (130 A.D.-200 A.D.)

Luis H. Toledo-Pereyra

In 130 A.D. Pergamon (as known in the Western world), a Greek town of Roman law near the Aegean in Asia Minor, became the birthplace of somebody particularly unique, someone who would drastically modify the course of history. Galen (130-200 A.D.), the revered physician and surgeon, saw his first light in this city of antiquity when the only serious medical concepts originated from Hippocrates.[1-9] Galen learned the important Hippocratic precepts rather swiftly and then set out to improve the prevailing system of medical principles and treatments.

Galen came from a family of respectable economic means. His father Nikon, an engineer and landowner, believed in the extraordinary benefits of a humanistic education, particularly in philosophy, natural sciences and mathematics. Spurred by a dream from Aesculapius, the god of healing, Nikon advised his son to become a physician.[2,3,7] Without hesitation, Galen pursued his medical education in Smyrna (today Izmir, Turkey), Corinth, Phoenicia, Palestine, Crete, and in the famous Egyptian city of Alexandria, the ancient site of so many anatomical discoveries. Five hundred years earlier, Herophilus and Erasistratus had established the greatest center of anatomical studies in Alexandria. The city had a great deal to offer a young and ambitious mind like Galen's.

Galen returned to Pergamon fully qualified to practice medicine and having completed a well-outlined and comprehensive postgraduate course (even better than contemporary postgraduate programs). Upon his return, he was offered the position of physician and surgeon to the gladiators. For 3 years, he absorbed the details of this profession, and then he left again, this time for the flourishing capital of Rome.

While in Rome, in 161 A.D., he patiently positioned himself to be considered by the political leaders of his time. When the wife of the Roman Consul, Flavius Boethius, fell ill, Galen cured her. The Consul became Galen's loyal supporter, to the extent of setting up a room for his animal dissections.[6-9] This welcome sponsorship allowed Galen to expand his theoretical knowledge of anatomy, physiology, and surgery.

After four years in Rome, Galen quietly returned to Pergamon where two years later the Roman Emperor Marcus Aurelius recalled him to become the court physician in Rome (168 A.D.). Galen remained in this position under four emperors for more than 30 years until his death in 200 A.D.[1-9] These decades in Rome proved extraordinary for both his writings and dissectional work.

Galen was a consummate and prolific writer, completing more than 400 books, of which 83 are well identified.[5] To support his exhaustive writing in anatomical and physiological studies, he employed a group of scribes paid directly through his own funds. No other physician of antiquity, or of modernity for that matter, produced

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

such a voluminous number of scholarly works. Since human dissections were not allowed by Roman law, the majority of Galen's anatomical and physiological studies concerned animals (macaque monkeys and pigs) rather than dead humans.[2,5-9]

Galen had an extraordinary acumen for diagnosis and treatment of common and unknown diseases. His outstanding diagnostic skills allowed him to advance his sociopolitical life. Galen was also a superb scientist and experimenter, one who wanted to demonstrate how natural phenomena occurred and to explain the function of the body. Galen took anatomy to the highest level achievable in his time. As an able anatomist and gifted surgeon, he understood the body, respected tissues, and aimed for the best tissue and organ function after surgical repair. While he cared for gladiators in Pergamon, an exceptional recovery rate was noted among injured slaves,[2,3,7,8] which added luster to Galen's reputation as a respected surgeon and physician.

Galen's contributions to physiology were many and remarkable. He proposed that arteries contained blood, that severed arteries would bleed the blood contained in them, that arterial pulsations originated from the heart, that the diaphragm and chest wall created a partial vacuum for the lungs to inflate or deflate during respiration, that urine was produced in the kidneys and not in the bladder, that the phremic nerve controlled the diaphragm and partly the chest wall movements, that spinal cord transverse incisions resulted in paralysis of all the nerves below, and that voice came from the larynx and was directly related to the recurrent laryngeal nerve, as well as other important developments. But Galen was not correct in all his assumptions; he never understood circulation as William Harvey later brilliantly described it. He never fully perceived the Harveian principles of blood circulation. He presumed there were pores between the left and right ventricles that allowed the "pneuma" to pass through. And he thought that the liver transformed digested food into blood, supplying nourishment to the body.[2,8,9]

Galen's anatomical accomplishments were multiple and varied. He described the bones of the human skeleton, their anatomical configuration and details. The joints, ligaments, and muscles were largely introduced from his work with apes, pigs and oxen. He presented a superior analysis of the cranial nerves, the nervous ganglia, and the sympathetic system.[8] His angiology needed some refinement and was not as well defined as his osteology and mycology.[8] Galen's writings, as deficient as they were in some respects, were consistently followed until the high Renaissance when Andreas Vesalius and William Harvey debunked some Galenic writings and teachings.[2,6-9]

As a superb surgical professional, Galen made his mark. He operated on tumors, hemorrhoids, varicose veins, hydroceles, abdominal walls, intestines, and nasal polyps, and performed cleft-lip reconstructions and other procedures.[9-11] He utilized common surgical instruments of the time, such as scalpels, forceps, hooks, arrow extractors, retractors, and scissors.[9-11] He was a formidable surgical tactician with incredible anatomical and physiological knowledge, which he extrapolated into sound surgical practice. He advanced surgery by acknowledging well-known principles, improving surgical techniques, and enhancing his vast experience with gladiators, which permitted him to achieve better outcomes than his contemporaries.[2,3,7,9]

Galen's self-praised, egocentric, petulant, and intolerant personality was surpassed only by his brilliance, his determination, and the canonical status of his writings.[8] That Galen impeded the advancement of medical sciences for more than a millennium cannot be readily accepted. Nor can the timidity of his medical peers, who did not have the necessary courage to challenge some of his perilous assertions. History has judged all of them and they all remain equally responsible for accepting Galen's dogmatic writings on one hand and not proposing alternatives on the other hand.

In summary, Galen's influence remains unparalleled by any other physician's before or since. Even the father of medicine, Hippocrates, did not have the intense and pervading effect that the surgeon of gladiators had on the world's medical thought and practice.

References

1. Talbott JH. A Bibliographical History of Medicine. New York: Grune and Statton, 1970:12-15.
2. Nuland SB. Doctors. The Biography of Medicine. 2nd ed. New York: Vintage Books, 1995:31-60.
3. Sigerist HE. The Great Doctors. New York: Dover, 1971:68-77.
4. Bettmann OL. A Pictorial History of Medicine. Springfield: Charles C. Thomas, 1962:42-47.
5. Green JR. Medical History for Students. Springfield: Charles C. Thomas, 1968:41-47.
6. Inglis B. A History of Medicine. Cleveland: World, 1963:35^0.
7. Haggard HW. The Doctor in History. New Haven: Yale University Press, 1935:91-100.
8. Si nger C. A Short History of Anatomy and Physiology from Greeks to Harvey. New York: Dover, 1957:46-65.
9. Conrad LI, Nerve M, Nutton V et al. The Western Medical Tradition. 800 BC to AD 1800. Cambridge: Cambridge University Press, 1995:52-70.
10. Rutkow IM. Surgery. An Illustrated History. St. Louis: Mosby-Year Book, 1993:38-42.
11. Toledo-Pereyra LH. Galen's contribution to surgery. J Hist Med 1973; 28:357-375.

Chapter 10

Avicenna (981 A.D.-1032 A.D.)

A. Karim Qayumi

In ancient times, when the world was thought to be flat and the oceans were not discovered, the only means of travel and communication was over the land. Knowledge of the existence of exotic civilizations such as China, India, and Persia forced European explorers, businessmen, and conquerors (including Marco Polo and Alexander the Great) to reach Asian countries by a long road that extended from Europe to China and India. This road was called the "Silk Road" due to silk's importance and commercial value for Europeans at that time. Silk, however, was not the only commodity that was exchanged on this road. The most important commodity for the future of mankind was the cultural exchange among the entirely different civilizations.

Somewhere in the middle of the Silk Road, a great city was built where most of the cultural and commercial trades took place. The city, Balkh, was called the "Mother of the Cities," not because it was the largest city in the East, but because it encompassed a mixture of Eastern and Western civilizations with respect to knowledge, cultural entities, commercial products, and others. This was probably the first truly multicultural city.

In 981 A.D., this city gave birth to a genius of the time who became one of the leaders in the expansion of knowledge for the entire world. His name was Abu Ali Ibnecina, known in the West as Avicenna. He was an extremely talented individual who memorized 30 books of the Koran by the age of 10. being in the grassroots of world civilization, he studied and learned Chinese, Greek, Roman, Indian, and Persian philosophy. He gained extensive knowledge and most of the available information. By the age of 21, he was able to categorize and classify all the knowledge and create the first encyclopedia. This encyclopedia is called Alhefa and was written in 15 books. Avicenna's talent covered all sides of knowledge from philosophy, astronomy, geometry, mathematics, and medicine to poetry and music. Although medicine was not his main area of interest, he became famous as a doctor due to the desperate need for thoughtful medical personnel in the Persian kingdom. Most of his childhood was spent in the peripheral part of the Persian Empire, Balkh and Bokhara, and most of his adolescence was spent in Hamadan and Asfahan. Avicenna was raised and lived most of his life in a time of political turmoil. The Samanid house was defeated by Mahmud of Ghazna (a legendary hero who established Ghaznaud rule in Khorasan, which is modern western Afghanistan) and the local dynasties were trying to gain political independence from the Abasid Caliphate in Baghdad. In the midst of this political climate, Avicenna had to move from one city to the next. However, Avicenna's power of concentration and intellectual prowess was such that he was able to continue his intellectual work with remarkable consistency and continuity. About 260 books and manuscripts are known to be written by

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

him, of which 240 are written in Arabic and the remainder in Persian. That is why Avicenna is mistakenly considered to be an Arab by some Western authors who are not fully aware of his origin. Arabic was a dominant language at the time because of the Islamic cultural influence on middle Asia. The fact that all of Avicenna's monographs were burned in Baghdad's central square about 100 years after his death indicates that Avicenna's philosophy and beliefs were not in favour of fanatic Arabs.

Among Avicenna's writings, his medical book *Al Kanon Fe Teb*, known as *Kanon* in the Western Hemisphere, has had great scientific and historical value. *Kanon* is a categorized and classified presentation of Persian, Indian, Chinese, and Western medical knowledge and is written in three parts. Part I covers the anatomy and physiology of the human body. Part II includes the description, signs, and symptoms of disease. Part III describes the treatment of disease and prophylactic measures to prevent disease. The *Kanon*'s organization and depth of knowledge made it a part of the curriculum of all Western universities for about 800 years. For the historic importance of this book, it is probably satisfactory to mention that, in the16th century when the printing machine was discovered, the first book after the Bible that was given priority to be published was *Kanon* by Avicenna. *Kanon* was translated into Hebrew by a famous Jewish physician named Mamo Nidaz (Moses Ebnay Mymon 1135-1204) that may have played an important role in the preservation and spread of an important role in the preservation and spread of medical knowledge between the eastern and western hemispheres.

The philosophical and medical beliefs of Avicenna may have been controversial at the time for some investigators, however. Michelangelo once said, "I'd rather be wrong following Galen and Avicenna than to be right following others." A good example of the strength of his multicultural knowledge is the fact that about 60 variety of pulses were known to Avicenna, 42 of which he inherited from Chinese medicine. He also used alcohol for anesthesia, as was known and was described by Chinese physicians in the first century A.D. He also used opium for anesthesia, as was known in Indian and Persian medical practices. He used ligature and coagulation for hemostasis and retraction for broken bones and spine deformations. It has also been documented that Avicenna performed an operation similar to cholecystectomy on the most famous pharmacopist of the time, Al Behroni. Despite outstanding surgical accomplishments for his time, Avicenna was a naturalist. He preferred medical treatment for most diseases with food, behavior, and medicinal plants. Very rarely, mostly for urgent cases, he used chemical elements or compounds such as derivatives of silver, copper, or iron. With the development of modern medicine, naturalistic and prophylactic approaches were condoned for a long time. In recent years, however, the naturalistic approach to medicine is becoming more acceptable. If history repeats itself, it is possible that forgotten physiological parameters such as warm, cool, wet, and dry will be explained in modern medicine for balancing human nature.

Avicenna died at the age of 62 in 1032 A.D. when he was traveling from Asfahan to Tehran. The last words he said before his death were:

> *I lived my life in glory and in joy.*
> *Discoveries ran in my head like a plough boy*
> *but even so, I could not understand*
> *the mystery of a small particle in a toy.*

Avicenna is buried in Hamadan and his tomb is visited every day by hundreds of sick people in the hope of a medical miracle performed by Avicenna. In order to acknowledge Avicenna's achievements and his role in the advancement of knowledge, including medicine, UNESCO asked the world to celebrate his 1,000th birthday as a "bright star from the East."

References

1. Browne EG. Arabian Medicine. Cambridge: Cambridge University Press, 1920.
2. Levy R. Avicenna; his life and times. Med Hist 1957; I:249.
3. Chatard JA. Avicenna and Arabian medicine. Bull Johns Hopkins Hosp 1908; 19:157.

Chapter 11

Leonardo da Vinci (1452-1519)

Luis H. Toledo-Pereyra

Leonardo da Vinci (1452-1519) epitomized the Renaissance, living, thinking, and creating art and technology that still characterizes that age of discovery. He typified the free spirit, zest for life, and nature of the ultimate Renaissance man. Indeed, he was an extraordinarily gifted genius who greatly advanced knowledge of the arts, such as drawing, painting, sculpting, as well as architecture, warfare technology, navigation, and many other critical aspects of human interest. His intense commitment to knowledge did not stop with these fields either. He also advanced anatomy to previously unknown levels. This writing delves into Leonardo's contributions to anatomy and explains how his discoveries subsequently facilitated the practice of surgery.

Leonardo learned anatomy initially from the old Greeks and Romans. He studied Galen as interpreted by Mondino, Avicenna, Magnus, Saxony, and Benedetti.[1] Elmer Belt, a distinguished Leonardo scholar, accurately reported and interpreted da Vinci's technical innovations and discoveries in anatomy in 1955.[1] He recognized that the Florentine master treated anatomy as a science and that the detailed characterization of the anatomic structures in his exceptional drawings, where function was an intimate part of structure, represented the enormous innovative force of the artist. Leonardo was a scientist studying anatomy. Yet Leonardo was also a consummate artist creating magnificent portraits. So Leonardo, the anatomist in his post-mortem dissection laboratory, also breathed life into the inert anatomical form.

Leonardo immersed himself in human post-mortem examinations as the best means of defining the structures of the human body. He critically examined 30 human corpses at a time when nobody was performing these examinations.[1,2] He went from fetuses to babyhood to old age. He wanted to recognize each part of the human body, including bones, muscles, ligaments, nerves, and the central nervous system. He defined the importance of the heart, its four cavities and the contraction of the ventricles.[1,2] He advanced the knowledge of all abdominal organs, particularly the genito-urinary system, as well as the rest of the thoracic organs. He not only studied human anatomy, but also the bodies of pigs and oxen, his preferred animal for dissections.[1]

For more than forty years (1472-1513), Leonardo performed anatomical studies.[1] He believed that experience in anatomy could only be attained with dissection. His favorite equipment included a sharp knife, chisel, and bone saw, in addition to charcoal, drawing board and sheets of paper, pencils, pens, and ink. No one knows how he preserved the bodies of cadavers. Whatever method he used, the bodies did not last for more than a few hours or days and were studied under strenuous circumstances, probably at nights, without assistance, and lacking good ventilation.[2]

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Therefore, his dissections and drawings had to be quick, precise, and without any wasted movements.

Leonardo's discoveries in anatomy were numerous,[1-5] among them: (1) detailed descriptions and drawings of the largest number of human bones, ligaments, nerves, muscles and internal organs that had been recognized up to then; (2) development of functional anatomy; (3) characterization of cross-section anatomy; (4) definition of physiological studies in animal experimental conditions, such as spinal reflexes, heart pulsations, and systolic contractions, mechanisms of voice, etc.; (5) classification of muscles with differentiation of supinators and pronators; (6) characterization of the heart muscle and vascular structures, including realizing that the coronary arteries receive their blood from the aortic value during diastole. However, Leonardo missed the circular movement of the blood proposed a century later by William Harvey (1578-1657); (7) description and naming of the capillaries; (8) determination of the function of the intercostal muscles and the diaphragm; (9) description of the peripheral nerves and their action in the function of muscles; however, he missed the nerve endings by believing they emerged as tendons; (10) utilization of hot wax to identify the shape and size of a body cavity, such as the ventricles of an ox brain; (11) description of all cranial nerves, including the olfactory nerve, but no reference to the optic nerve as one of them; (12) correct analysis of the upper gastrointestinal anatomy and function, but he failed to describe intestinal peristalsis; (13) characterization of all other abdominal organs and structures, such as the liver, spleen, omentum, large bowel and genito-urinary system; (14) illustration of the vascular system in a transparent-like manner; (15) characterization of the human fetus in the mother's uterus; (16) definition of the double curvature of the spine and the number of vertebrae, but Leonardo incorrectly thought the spinal cord extended the entire length of the spinal canal and believed the nerves followed the course of vertebrae instead of vertebral arteries.

The immense pioneering anatomical work of Leonardo preceded the work of the father of anatomy, Andreas Vesalius (1514-1564), by at least a generation. The work of Leonardo never reached Vesalius or other physicians of the time. Instead, Leonardo's monumental contributions remained hidden in old wooden boxes after his death in 1519. His initial heir, Francesco Melzi, did not appropriately dispose of the drawings and at his death in 1570, they tumbled from Orazio Melzi to Pompeo Leoni, Thomas Howard, Earl of Arundel, King Charles I, Queen Mary II of England, and Robert Dalton, librarian of Kensington Castle, who rediscovered them in 1760 and showed them to William Hunter (1718-1783). Hunter, in turn, described them to his students and to Blumenbach of Gottingen who wrote about them in 1788.[1] John Chamberlaine published the drawings in 1796 for the first time.[1] Subsequent publications appeared in 1892, 1901, 1911-1916, and 1952, with the last one of O'Malley and Saunders[3] being the most updated, including a chronological evaluation of the drawings and text.[1-4] According to research by Belt,[1] it is possible that Gaddiano, Vasari, Lomazzo and Duner had seen the amazing anatomical drawings of Leonardo while they were in possession of Francesco Melzi. In spite of this, Leonardo's drawings did not enter the curriculum for contemporary surgeons. Only several generations later would his incredible work leave the abandoned boxes in Kensington Castle and emerge to the enduring benefit of dedicated practicing surgeons.

Leonardo's work finally reached the surgical community only in the second half of the 18th century. Subsequently, well-informed surgeons became acquainted with the extraordinary anatomic drawings of da Vinci, which were utilized for the better understanding of human anatomy. Leonardo's extraordinary advances in anatomy led the way for surgeons, who could utilize his concepts and ideas on the repair of afflicted organs or the surgical removal of disease. His anatomical works offered new detail for the surgical treatment of previously unexplored areas. Because of this, surgeons owe him a debt for facilitating and enhancing the practice of surgery. Furthermore, since his work predated the contributions of Vesalius, Leonardo could be considered the Hidden Father of Modern Anatomy.

References

1. Belt E. Leonardo the Anatomist. Lawrence: University of Kansas Press, 1955.
2. White M. Leonardo. The First Scientist. New York: St. Martin's Griffin, 2001.
3. O'Malley C, Sanders JBCM. Leonardo da Vinci on the Human Body. New York: Schuman, 1952.
4. Persaud TVN. Early History of Human Anatomy. From Antiquity to the Beginning of the Modern Era. Springfield: Charles C. Thomas, 1984.
5. Nuland S. Leonardo da Vinci. New York: Penguin Press, 2001.
6. Persaud TVN. A History of Anatomy. The Post-Vesalian Era. Springfield: Charles C. Thomas, 1997.

Chapter 12

Ambroise Pare (1510-1590)

Mahnaz Sherozi

France was in a constant state of transition in the 16th century, trying to gain political and religious control over a collection of medieval states. The medical profession in Paris reflected the country's instability as the Crown and Parliament loosely regulated the system that was rigidly divided into three classes. The first class included the physicians who controlled the medical schools and guarded the Faculte de Medicine's rights and privileges. They were churchmen who studied medicine along with Latin, Greek, and mathematics at the universities. Medicine was taught in Latin with emphasis on classical authorities like Hippocrates, Galen, and the translations of Arabic texts. Surgery and anatomy were taught theoretically, with hardly any contact, communication, or experience with patients, and field experience was dismissed as unreliable knowledge based on chance. Students graduated without performing or even watching a dissection. Their texts were sparsely sprinkled with illustrative diagrams. Upon gaining the status of physician they would treat patients by comparing the symptom reports to ancient textbook lists or, in some instances, diagnosing their patients from a distance.

If it would become necessary to use medical instruments, deal with blood, or perform surgery, the physician would utilize a barber-surgeon to perform these tasks under his supervision. Surgery was a lowly profession that the physicians justifiably abhorred in this time before anesthesia. Restraints had to be used and surgery was only considered as a last option to treat misery.

Barbers who were skilled with the razor were the logical choice in performing operations, and thereby constituted the second class of the medical profession. They earned licenses after serving on apprenticeship followed by two examinations. The barber-surgeons were uneducated people who spent their days in shops shaving, trimming, and clipping. The apprentice's medical knowledge mainly came from word of mouth, French translations of a few books (if they could afford to buy them), and lectures that physicians would give at 4 o'clock in the morning so they wouldn't interfere with business practices (since the apprentices had to be present in the shop at dawn). These apprentices basically did all the dirty work such as performing obligatory dissections for physicians, taking blood, and draining abscesses.

The third class consisted of a few ambitious characters that dared to go beyond the system. They were either barber-surgeons who managed to take university classes or physicians who wanted to perform surgery even though hands-on contact with patients was prohibited for them. Out of this rank came Ambroise Pare, whose exhaustive treatment of wounded soldiers in war and his research publications based on those experiences, revolutionized the modern world of surgery. Called, "the father of modern surgery," he was born in Bourg-Hersent, France in 1516 to a poor

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

family which was supported by the humble salary his father brought home from cabinet making. His father managed to pull favors so Pare could get Latin lessons. The young Ambroise exchanged his services for Latin lessons by maintaining gardens and tending mules.

He got the opportunity to assist a surgeon who'd come to operate in the house where he was boarding. This chance captured his interest and in 1532 he decided to go to Paris to learn more. He followed university lectures and eagerly studied while serving as an apprentice to a barber-surgeon. The lectures' generalizing information on tumors, ulcers, and wounds was not enough for him, so he read French translations of the masters, his main influence being Guy de Chauliac. He was frustrated with the incomplete education he received at the barbershop and left to start what we would call an internship in the Hotel Dieu, the only public hospital in Paris. It was managed by a group of Catholic lay-brothers and sisters sworn to service to the poor, and the work he did in this chronically crowded hospital was an accomplishment he always spoke of proudly in later years. He studied sick people, assisted with operations, performed some operations himself, and did autopsies and dissections for professors.

> *It should be known that for the space of three years I lived at the Hotel-Dieu of Paris, where I had the chance to see and to learn all possible changes of the human body by disease; and also learned there on an infinity of dead bodies all that could be said and considered on anatomy;*

His experience in the Hotel Dieu was the groundwork for his accomplishments as a military surgeon. In 1536 war started again when Charles V threatened to make France part of his empire, and Francis I sent an army in defense with Pare as part of the campaign. Ambroise Pare had never seen war or treated a gunshot wound. He had only read about them in books. Now on the battlefield, he watched other surgeons to mimic their treatment. The standard treatment for gunshot wounds was an application of boiling oil for cauterization. Overwhelmed by the number of incoming casualties and worried about the oil shortage, Pare one day quickly improvised a new concoction with a mixture of egg yolk, rose oil, and turpentine. The next morning he awoke to find that patients treated with his mixture were healing better than those treated with boiling oil. At age nineteen, Pare challenged a universal doctrine held by the most renowned surgeons of his time and established a new treatment. In the campaigns following, his reputation grew amongst soldiers and great lords and these whispers finally fell upon the ears of Sylvius who invited Pare to dinner. Sylvius, one of the most famous lecturers of the time, encouraged Pare to publish his work. In 1545, with the support of the University of Pairs, Pare's first book, controversially written in French instead of Latin, was made available to the public. Entitled: "The method of treating wounds made by arquebuses and other firearms; and those made by arrows, darts, and such; also from combustions made especially by cannon powder; written by Ambroise Pare, master barber-surgeon at Paris."

In this same year, he was called back to service to accompany the Duke de Guise as his personal surgeon in the siege of Boulogne. There the Duke received a lance thrust through his face, which Pare successfully removed. Pare was always learning, researching, and challenging his own previous assumptions. In all the towns he traveled, he collected new cures from old surgeons and continually performed dissections when he could. During peace he devoted himself to the study of anatomy. In 1550 he published the findings of his dissections and he quickly rejoined the army.

There he encountered a soldier who had been wounded with a dozen severe sword thrusts, whose grave had been dug already. Pare objected and instead had him carried on a cart where he tended to his patient, "in capacity of physician, surgeon, apothecary, and cook," and nurtured him back to health.

The honest displays of his skill and humanity were constant. He proposed application of ligature to veins and arteries after amputation instead of a horribly painful practice of searing hot iron to prevent hemorrhaging. By 1553 Pare was a well-respected, honored, and cherished member of the army. It was said that soldiers would heal faster just knowing Pare was coming to help them. He was carried like a holy man on the shoulders of soldiers through the streets of Metz. By that time Henry II, then the King of France had become fully aware of Pare and offered him the position of surgeon-in-ordinary, which he kept after Henry's death into the reigns of Francis II, Charles IX, and Henry III, finally reaching the status of premier-surgeon in 1564.

Ambroise Pare will always be remembered for his first innovation in healing gunshot wounds, but he was also one of the first surgeons who did away with the practice of castrating patients who required surgery for a hernia. He introduced teeth implantation, artificial limbs, and artificial eyes made of gold or silver. With his innovations came the invention of new scientific instruments, and he was the first to suggest that syphilis may be a cause of aneurysm. Though he was much criticized and scoffed at by the intellectual community for publishing in vernacular French instead of Latin, Pare persevered to provide knowledge to the general public. He gave his life's work to improving his profession. He was the first significant surgical writer since Guy de Chaulic and Jean de Vigo. Yet he went above and beyond his mentors in his treatises. When he died he left behind a lively and effective surgical faculty, which he had gathered through his influence, and they continued the growth of the field for generations to come.

References

1. Malpaigne JF. Surgery and Ambroise Pare. Translated from French and edited by W.B. Hamby. Norman: University of Oklahoma Press, 1965.
2. Talbott JH. A Biography History of Medicine. New York: Grune and Stratton, 1970:60-62.

Chapter 13

Andreas Vesalius (1514-1567)

Hellai Sherzoi

Andreas Vesalius is arguably the founder of modern anatomy, having greatly advanced the science with his detailed descriptions and drawings of human anatomy. His greatest contribution was his major work titled "De humani corporis fabricca libri septem" ("Seven Books on the Structure of the Human Body") published in 1543, which contained not only detailed descriptions and drawings of the human anatomy, but rudiments of anthropology. Sentenced to death by the Inquisition for his new approach of the dissection of human cadavers, he journeyed instead to a pilgrimage to Jerusalem.

Vesalius's intellectual activity was sterilized due to his pursuit of knowledge into the secrets of impiety with a scalpel. Such activity led to charges of impiety because dissection was considered sacrilegious. Despite these setbacks, which he was forced to confront in his later years, his achievements shed new light on many areas of the anatomy that Galenic teachings had asserted.

Vesalius was born in Brussels in 1514. With a great family tradition in the field of medicine, he followed accordingly and attended the University of Louvain. There, he obtained a thorough knowledge of ancient languages as well as Greek and Latin, and more importantly, he discovered the road to the study of anatomical sciences. This interest led to his sojourn in Paris where he studied the works of Hippocrates and Galen. Sylvius was the first French professor who had taught anatomy from the human cadaver. His chief flaw, however—as with many of his contemporaries—was blind reverence for ancient authors such as Galen. Galen's works were regarded as infallible and further progress into anatomy seen as impossible.

In addition to Sylvius, who performed the invaluable task of naming muscles, which prior to this period were designated by numbers, Vesalius was influenced by several notable professors. Among these were Joannes Guinterious, who brilliantly translated the writings of the most noted Greek medical authors into Latin; Jean Fernel, whose writings encompass a variety of subjects such as physiology, surgery, and pathology; and lastly, Pierre de la Ramee, also known as Ramus, who was an uncompromising opponent of the Aristotelian philosophy, suggested that reforms be made in University education. While Vesalius was able to acquire vast knowledge from these medical experts, his anatomical teaching in the early part of the sixteenth century was lacking. Vesalius considered his knowledge unsatisfactory and was very critical of the excessive lectures and theories from Galen's texts. "Vesalius, who was not backward in his criticisms, says that the dissections were made by ignorant barbers, and during the whole time that he was in Paris he never saw Guinterious use a knife upon a cadaver," concludes James M. Ball, who has written a book titled "Andreas Vesalius: The Reformer of Anatomy."

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Thus, Vesalius longed to have a chance at dissecting. The rare instances when dissections were made during his studies were done so in a superficial study of the intestines and abdominal muscles. Taking matters into his own hands, Vesalius launched his search for human cadavers and began his intricate studies of the anatomy. He soon became a master at elaborate dissection of the abdominal organs and of the muscles of the arm.

With the outbreak of the third FrancoGerman war, Vesalius returned to the University of Louvain and obtained cadavers by secret means. It was during this period, in late 1536, that Vesalius conducted a public anatomy dissection while lecturing at the same time. Shortly thereafter, he traveled to Padua, Italy, where he was appointed Professor of surgery at the University of Padua. His teachings and public dissections in Padua inspired the contents of a number of books published, with the most renowned titled "Fabrica," published in 1542.

The Fabrica was perhaps his greatest contribution to the study of anatomy. The errors which were rectified and the improvements that were made in anatomy are numerous and noteworthy. The Fabrica, composed of seven books, is clear and concise, filled with detailed work in not only anatomy, but also anthropology and physiology. Vesalius devotes his book to descriptions of the ligaments and the muscles organs of nutrition, contents of the thorax, and anatomy of the brain, the cranial nerves, and the organs of sense. He was the first who correctly described the osseous system in its entirely thereby directly opposing the opinions of Galen; the first to give an accurate description of the sphenoid muscle. Moreover, he denied the existence of the intermaxillary bone in adults, and showed that the inferior maxilla does not consist of two pieces, a position asserted by Galen. He also proved the existence of marrow in the bones of the hand, previously denied by Galen. Vesalius maintained that the nerves and muscles do not stand in any relation of proportionate strength to one another, large nerves often being distributed to small muscles. Also, he held that tendons are similar in structure to ligaments. More than an anatomist, Vesalius was a remarkable physician who laid the foundation of our present knowledge, overthrowing many authorities in anatomy.

In 1544, Vesalius left Italy to take up residence in the court of Charles V Madrid. Due to the Inquisition, life in Spain was not favorable towards the study of science. In 1564 Vesalius was accused of impiety and sentenced to death but Phillip II interceded and instead allowed him to make a pilgrimage to Jerusalem as his punishment. Shortly thereafter, in 1567, news of his death reached Brussels.

In recent years, many have attempted to show that it was in fact Leonardo da Vinci, and not Vesalius, who was the founder of modern anatomy. While a considerable amount of literature has been devoted to this controversy, Vesalius's studies are said to have revolutionized anatomy.

Reference

1. O'Malley CD. Andreas Vesalius of Brussels 1514-1564. Berkeley: University of California Press, 1964.

Chapter 14

John Hunter (1728-1793)

Simon Bartley

Many medical students have studied Hunter's canal without much thought about whom this anatomic structure was named for. This is unfortunate, as John Hunter was arguably one of the most influential surgeons ever to practice medicine. His contributions to surgery, pathology, anatomy, and physiology were immense and remain today as important milestones in the development of medicine.

John Hunter was born in Scotland in 1728. He grew up seven miles outside of Glasgow among ten siblings and came from modest upbringings. At school he was known to be an unsatisfactory pupil, both bad tempered and mischievous. However, he was also a curious boy who would ask questions about science and nature that more often than not none could answer. At the age of 20, with little direction in his life, Hunter decided to move to London and work for his older brother William. William Hunter was an anatomist and surgeon of considerable repute at the time. He spent time giving private instruction and practical demonstrations to various surgeons of London. As William's assistant, John would spend his waking hours keeping affairs in order and procuring human cadavers for the demonstrations. As human dissection was illegal at the time, this often involved socializing with the "resurrection-men". These men were responsible for obtaining the cadavers and other materials by whatever means necessary. John showed much aptitude in anatomy and dissection and was promoted to demonstrator within a year. Soon after, though having never received a formal education, Hunter became a surgical apprentice at St. Bartholomew's Hospital. There he was taught by such surgeons as Cheselden and Percivall Pott. Three years later Hunter moved to St. George's Hospital where he spent his next 25 years practicing as one of the leading surgeons of London.

During his years of practice, Hunter began private studies of comparative anatomy, embryology and physiology at his home in Earl's Court. Here his country manor became the laboratory where much of his dissection and experimentation were done. Hunter believed in the importance of examining different species in order to understand organ form and function. His home was compared to a circus as he collected various animals including leopards, buffalo, ostriches, insects, zebras, and snakes. He also obtained the skeleton of a bone-whale and the cadaver of the Irish giant O'Brien for which he paid the unheard sum of 500 pounds. His collection (the Hunterian collection) of anatomic dissections and bizarre animals eventually became a large part of the museum of the Royal College of Surgeons in London.

Hunter's thirst for science and experimentation remained unabated for much of his life. His work and discoveries were broad in scope and diverse in nature. Hunter discovered the lacrimal duct in the human, elucidated the thermoregulatory mechanisms of the hedgehog, speculated on artificial insemination, and studied venereal

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

diseases. Additionally Hunter's work on popliteal aneurysms became a hallmark in vascular surgery. Preceding Hunter, these aneurysms were treated with proximal and distal ligatures with resection of the sac, which most commonly resulted in eventual limb amputation. Hunter's idea was to ligate the femoral artery proximally in the adductor canal. He hypothesized this would take the pressure of the aneurysm and that collateral circulation would remain to supply the lower limb. Six weeks after experimentally performing this operation, his first patient walked away from the hospital on both feet. Hunter's advances have undoubtedly saved thousands from certain limb loss due to popliteal aneursyms.

Perhaps the strongest influences on John Hunter came during the war against France and Spain. While working as an army and naval surgeon, Hunter gained considerable experience dealing with gunshot wounds. He viewed every wound and treatment as a separate trial in the management of these injuries. At the time, the standard surgical treatment for gunshot wounds was to enlarge to external orifice and manually extract all debris. However, Hunter was not in favour of this approach. He instead describes cases of successful healing of gunshot wounds via primary intention with removal of only easily accessible debris. Hunter also made observations on surgical shock, blood coagulation, inflammation, pyemia, phlebitis, and wound healing. Many of these observations later became formalized in his most famous work, "Treatise on the Blood, Inflammation, and Gunshot Wounds." In this, Hunter clearly describes inflammation as a process or reaction of the body to any noxious stimulus. He recognized that inflammation could either contribute to, or resolve disease. This was ground breaking at the time, as many still considered the body's humours as an integral part of the disease process. Hunter's work remains a development milestone in general pathology.

John Hunter was much more than a leading surgeon of his era. He was a teacher and pioneer in the field of science and medicine. Though never a great lecturer, Hunter put forward original ideas on pathology, anatomy, and physiology in a time when thinking was dominated by traditional theories. He influenced and taught the likes of Edward Jenner (small pox vaccination), Astley Cooper, and Philip Physick. In his work, he combined the academics of basic science with the technical trade of surgery. Through this, Hunter was a catalyst in transforming surgery from an art to a science.

References

1. Sigerist HE. The Great Doctors. A Biographical History of Medicine. New York: WW. Norton and Company Inc., 1933.
2. Talbott JH. A Biographical History of Medicine. "Excerpts and Essays on the Men and Their Works." New York: Grune and Stratton Inc., 1970.
3. Zimmerman and Veith. Great Ideas in the History of Surgery. New York: Dover Publications Inc., 1961.

Chapter 15

William Shippen, Jr. (1736-1808)

Luis H. Toledo-Pereyra

On October 21,1736, when William Shippen, Jr. (1736-1808), was born in Philadelphia, Anglo-Saxon America was under British dominance, medical schools did not exist, and physicians were trained by apprenticeship.[1,2] It was not a simple task to learn medical principles and to institute them in daily clinical practice.

William the younger, as he has been frequently called, attended distinguished schools in the East, including Samuel Finley's school at Nottingham and Princeton College in New Jersey, where he obtained his A.B. in 1754 as valedictorian of his class. He decided to follow in the footsteps of his distinguished father, William Shippen (1712-1801), a prominent and respected medical doctor in Philadelphia and one of the founders of the Pennsylvania Hospital in 1753 and of the College of Philadelphia (now the University of Pennsylvania), a trustee of Princeton College for 30 years, and a member of the Continental Congress elected in 1778. William Shippen, Jr., spent 4 years as an apprentice to his father, who had established a lucrative practice.[3]

In 1758 he traveled to London, where he studied anatomy and midwifery under the famous Hunter brothers, John and William. Such trips were customary among students who could afford them. After three years, in 1761, he obtained his medical degree from one of the premier medical schools of his time, the University of Edinburgh. His thesis, entitled De Placentae Cum Utero Nexu,[3,4] was critically acclaimed.

Upon his return to Philadelphia in 1762, Shippen organized the first course of anatomy lectures to be delivered in the United States. The first ones were given at the state house on November 16, 1762, and subsequently at his father's residence on Fourth Street. Shippen's knowledge and training, acquired in London from the great anatomist of the time, John Hunter, created a superb atmosphere for successful results, notwithstanding some public disturbances associated with popular criticism of human dissection.[4] His school of anatomy continued until 1765, when he was named professor of anatomy and surgery in the newly established medical school of the College of Philadelphia, the first one erected in this country. Shippen was one of the founders, along with his future and dedicated rival John Morgan (1735-1789). At about the same time, in 1765, Shippen began his lectures about midwifery, the first systematic course of obstetrics given in this country. He also actively practiced this specialty for many years.[4]

William Shippen, Jr., also committed great effort and dedication to his military medical career. In 1776, he was appointed to the position of medical director of the Flying Camp, a force of 10,000 troops operating in New Jersey.[3] The following year, he was named director general of all the military hospitals for the Armies of the

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

United States, which implicitly carried the responsibility of the position of Surgeon General of the United States. He demonstrated how to organize practices, gave attention to the poor, and showed a great capacity for improving medical programs for soldiers and medical personnel. This was not sufficient for John Morgan, Benjamin Rush, and their friends, who accused Shippen of ignorance, neglect, misapplication of hospital supplies and funds, and reporting misleading morbidity and mortality statistics.[4] A court-martial was ordered and on August 18, 1780, Shippen was fully acquitted and returned to the armed forces. On January 3, 1781, he resigned from the military.[3,4]

Free from military service, Shippen rededicated himself to the teaching and practice of surgery in his native Philadelphia. The year before, in 1780, he had been elected professor of anatomy, surgery, and midwifery at the University of the State of Pennsylvania. After the joining of the Medical College of Philadelphia and the state university in 1791 (under the name of the University of Pennsylvania), he continued as professor of anatomy until 1806 at the age of 70 years.[4]

During his London tenure, around 1760, Shippen married Alice Lee, of a prominent Virginia family.[4] They had a single son, who died in 1798. This event greatly saddened Shippen. In later years he withdrew from public functions, including teaching and practice. In 1808, he died in Germantown, Pennsylvania. As a well-known surgeon, Shippen spent his entire life attempting to achieve the best of medical practice and teaching. His eloquence as a university professor and his able demonstrations of clinical practice brought him fame and distinction in the medical field.[4] His shortcomings in the United States military medical services should not detract from his accomplished professional career or from the introduction in America of the systematic teaching of anatomy and midwifery. He should be recognized for these accomplishments as the Father of American Anatomy and Midwifery.

References

1. Conner BC. William Shippen, Jr. Philadelphia: American Philosophical Society, 1951.
2. Cryderman C. William Shippen. Father of Anatomy. New York: Warner Books, 1984.
3. William Shippen, Jr. in www.warmuseum.net/ revolutionarywarhall/ williamshippen.com
4. William Shippen, Jr. in www.armymedicine.army.mil/ history/tsgs/shippen.htm

Chapter 16

Benjamin Rush (1746-1813)

Alexander Horacio Toledo

With just cause, much has been written about a man who was the most radical of American patriots, a signer of the Declaration of Independence, a leading proponent in ratifying the federal Constitution and a cofounder of the first American anti-slavery society. When not consumed with the dynamic political landscape that typified our nation's infancy, Benjamin Rush (1746-1813) served tirelessly as an advocate for many social reforms including temperance, women's rights, and humane treatment of the mentally ill. Incredibly, Dr. Rush, eulogized as the American Hippocrates,[1] was equally adorned and accomplished in political and social science. However, while history has judged his noble and farsighted efforts in such arenas as women's education and the abolition of slavery with great appreciation, his medical legacy is marked with tremendous controversy. Should we revere Rush as a brave, humane, and pioneering physician, or were his blatantly ascientific theories and detrimentally heroic practices unworthy of the title of the American Hippocrates?

Energetic and confident in all his endeavors, Rush presented his heroic yet seemingly logical theories with characteristic vigor. In lectures, in writings, and most importantly in his considerable practice, Rush was unyielding in adhering to his monistic therapy of bleeding and purging. Perhaps reflecting Rush himself, his treatment was decisive and impatient. Typically Rush would "relieve" his patients of eight pints of blood over two or three days,[1] all the while giving them cathartics of unprecedented dosages. A patient's failure to respond to this disastrous therapy won him only another round of bleeding and purging. As was the norm for eighteenth century medicine, Rush felt no need to validate his theories scientifically.[2] In fact, despite being a shrewd and perceptive observer of disease, Rush never conducted any experiments in evaluating his ideas.[3] Simple logic served as Rush's sole criterion in justifying his unfortunate remedies.[3]

Without doubt, this increasingly prevalent brand of heroic medicine initiated and propagated by Rush cost thousands of American lives including his own. Many physicians of the time grew to question the efficacy of this harsh protocol, yet Rush, using his unparalleled stature among both his peers and his students, relentlessly promoted his theories. In this area, given the prescientific age of medicine, the impact of Rush's passion and eloquence should not be underestimated. Upon attending one of Rush's many lectures, Dr. Charles D. Meigs wrote, "I was enrapt. His voice, sweeter than any flute, fell on my ears like droppings from a sanctuary. with his earnest, most sincere, most persuasive accents, sunk so deep into my heart that neither time nor change could eradicate."[3] When considering Rush's reign of nearly four decades at the University of Pennsylvania, a medical school graduating nearly as many physicians as all the other schools combined,[3] his vast breadth of influence

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

is more comprehensible. With disciples in all corners of our expanding nation, Rush was able to disseminate his detrimental practices throughout the United States. It was not until fifty years after his death that his ideas of bleeding and purging were completely abandoned by American physicians.

Fortunately, heroic medicine was not the only context in which students and contemporaries were influenced by their encounters with Benjamin Rush and his writings. In fact, Rush's writings reveal that his "therapeutic dogmatism was, however, of a minor proportion of his teachings."[4] Much of Rush's efforts with students was oriented towards the virtues and demeanor that a physician must possess. With our young nation void of any medical tradition, and a European education a privilege enjoyed only by the elite, Rush's emphasis on etiquette and patient care provided subtle yet invaluable advice to early practitioners.

At a time when most Americans were preoccupied with securing the essentials for survival, Rush was unyielding in asserting that physicians had a primary and moral obligation to the sick and injured. Rush warned his students that it is "criminal" to promote "public amusement" above the welfare of one's patients.[5] Similarly, Rush also urged his fellow physicians to cultivate their sense of selflessness and sympathy. He was certain that it was these "heaven-borne" principles which "produce such acts as self-denial of company, pleasure and sleep in physicians. and enables them to sustain. the most laborious exertions of body and mind."[5] While such pontification from a lesser man might have been easily forgotten or deemed impractically chivalrous, the same is not true when spoken by a man of legendary commitment and compassion. 16

During the tragic Yellow Fever epidemics of 1793 and 1797,[1,2] Rush worked courageously and often without reward. When "in the terrorized city husbands abandoned sick wives, mothers their children," Rush was one of just three physicians who remained in the city to care for the sick and dying. Heroically, Rush saw 125 patients a day during the epidemics while he himself was often fatigued and depleted by the fever and bleeding therapy. It was with this admirable record of service that he held the collective ear of his colleagues when discussing the duties of a physician.

The Yellow Fever epidemic also provided Rush with an opportunity to set an important precedent in the care of the poor. As most educated people, including physicians, fled the infected city of Philadelphia, Rush shunned this aristocratic exodus. Instead, he toiled valiantly in the slums, caring for the struggling masses that had no means of reimbursement. While personifying the physician's allegiance to a higher calling than the dollar or pound, Rush reminded his profession that "the poor be the object of your peculiar care. Whenever you are called, therefore, to visit a poor patient imagine you hear the voice of the good Samaritan sounding in your ears, 'Take care of him, and I will repay thee'".[6] True to his frank and often combative nature, Rush publicly chastised many physicians for their inhumane practice of avoiding the poor and elderly. "It is an act of ingratitude, as well as avarice," Rush wrote, "to neglect them under the pressure of age and poverty, as well as sickness, or to consign them over to young physicians or quacks who are ignorant of their constitutions and habits".[5] Not surprisingly, Rush established the first free dispensary in the United States shortly after the Revolutionary War.

The value of a strong sense of duty and morality in a physician was not unique or original to Benjamin Rush.[6-9] However, given his unrivaled and exalted stature in his day, Rush was in the unparalleled position to yield an insurmountable influence on both his contemporaries and also the thousands of students he taught over four decades. His courage, dedication, and human approach personified the virtues he so often preached, and provided irrefutable evidence to a generation of physicians that these objectives are indeed tangible. While his detrimental methods of bleeding and purging were equally well absorbed into American medicine and served to severely retard medical progress for almost fifty years after his death, it would be unfair to judge his theories by our own stringent and scientific parameters. Rush's desperate measures must be understood in the context of a land that was full of disease and contamination yet void of remedies. As Rush himself astutely predicted when contemplating the status of our socially and medically unrefined nation, truth is universal, present in all endeavors of life. "It has been said that there is no such thing as a solitary error in the human mind. The same may be said of truths. They are all related, and delight in Society." As our world continues this quest for truth on many fronts, we owe our American Hippocrates a debt of gratitude for imprinting upon our malleable medical field the timeless virtues of duty and compassion.

References

1. Duffy J. The Healers. A History of American Medicine. Urbana: Univ Illinois Press, 1976.
2. Rothstein WG. American Physicians of the 19th Century. Baltimore: Johns Hopkins Univ Press, 1991.
3. Flexner JT. Doctors on Horseback. Pioneers of American Medicine. New York: Dover Publ Inc., 1968.
4. Veith I. Benjamin Rush and the beginning of American medicine. West J Med 1976; 125:17-27.
5. Rush B. Sixteen Introductory Lectures to Courses Upon the Institutes and Practices of Medicine, with a Syllabus of the Latter. Philadelphia: Bradford and Inn skeep, 1811.
6. Rush B. Observations on the Duties of a Physician. Philadelphia: Prichard and Hall, 1789.
7. Rush B. The Moral Library. I. Principles of Virtue and Morality. II. On the Happiness of the Life to Come. III. On the Immorality of the Soul. Boston: William Spotswood, 1796.
8. Rush B. The Road to Fulfillment. New York: Harper and Brothers, 1942.
9. Hawke DF. Benjamin Rush. Revolutionary Gadfly. Indianapolis: The Bobbs-Merrill Co. Inc., 1971.
10. Corner GW. The Autobiography of Benjamin Rush. Princeton: Princeton University Press, 1948.

Chapter 17

Philip Syng Physick (1768-1837)

Luis H. Toledo-Pereyra

For years, Philadelphia surgeon Philip Syng Physick (1768-1837) has been considered the father of American surgery. What did he do to be credited with such a distinguished title? How did he convince others of his merit? Who participated in bestowing such an honor?

A look back into the life and accomplishments of this notable surgeon reveals why he should be considered the father of American surgery. In actuality, Physick was not the first professor of surgery at the University of Pennsylvania, his alma mater for his undergraduate degree. William Shippen, Jr., had preceded Physick as the first professor of anatomy, surgery, and midwifery from 1765 to 1805.[1] In 1805, Shippen left the position vacant, and Physick took over a separate chair of surgery created especially for him.[2] He remained in this chair until 1819, when he resigned because of failing health.[2]

Philip Syng Physick, son of Edmund and Abigail Syng Physick, was a native of Philadelphia from a distinguished family.[3] His father was receiver-general of Pennsylvania as well as an agent for the Penn estates.[4] Physick's maternal grandfather, Philip Syng, was a renowned silversmith who designed the inkstand used for the signing of both the Declaration of Independence and the Constitution of the United States.[5] In 1800, Physick married Elizabeth Emler, and together they had seven children.[4] Ironically, this great man of surgical sciences had several health afflictions, including yellow fever, typhoid fever (or typhus), renal colic, and heart failure.[3]

Physick received his undergraduate degree at the University of Pennsylvania in 1785, and for the next 3 years served as an apprentice under Adam Kuhn, a respected local physician. In 1789, Physick began a 4-year-long tutelage under the famed British surgeon, John Hunter. During this time, Physick was appointed house surgeon at St. George's Hospital, and, after 1 year of apprenticeship, he received a diploma from the Royal College of Surgeons of London. He then moved to Edinburgh, Scotland, and again after only 1 year received his medical degree in 1792.[3,4,6] Physick remained with Hunter until 1793, when he returned to Philadelphia. In 1794, Physick joined the surgical staff of the Pennsylvania Hospital where he remained until 1816.[3,4] In 1800, he joined the Philadelphia Almshouse and began his lectures in surgery to the faculty of anatomy and surgery at the University of Pennsylvania (1800-1805).[2,4] Physick's lectures were in such demand that in 1805, a separate chair of surgery at the university was assigned to him.[2] Physick remained professor and chairman of surgery until 1819, when he transferred his professorship to anatomy until his retirement in 1831.[2,4]

Philip Physick's celebrated accomplishments were indeed impressive. He developed a successful and highly attended course in surgery, which culminated in a

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

two-volume book written by John Syng Dorsey. Himself also a physician surgeon and a nephew of Physick, Dorsey wrote with dedicated detail *Elements of Surgery* (1813), the first treatise on general surgery written by an American surgeon.[6] Physick was also a well recognized lithotomist, so much so that in 1831, after his retirement, he was called to remove multiple bladder stones from 76-year-old Chief Justice John Marshall. An uneventful recovery was reported.[2,3,6] Among his important contributions to surgery, Physick was the first American to: use seton ligatures for nonunited fractures (1804); use mechanical counteraction for dislocated femur (1805); report surgical repair of an arteriovenous fistula (1805); use a gastric tube for the removal of unwanted substances (1813); introduce absorbable ligatures of kid and buckskin (1816); treat fractures of the mandible with seton ligatures (1822); create a colocutaneous fistula for the treatment of strangulated hernia (1826); devise an operation for artificial anus (1826); develop the progenitor of all tonsil guillotines (1828); and create multiple surgical instruments for urological stone removal, tonsil snaring, hemorrhoidectomy, enucleation of the lenses, and many other uses and techniques.[2,6]

Samuel D. Gross, noted Jefferson Medical College surgical chairman of mid 19th century America and extraordinary surgical author, clearly recognized the significance and prominent legacy of Physick. In regard to Physick's extensive contributions to surgery, Gross stated, "He was really its first settler,"[6] further remarking that surgery was for a "quarter of a century almost his exclusive domain."[6] The title of "father of American surgery," according to Talbott,[3] originated from Bell in the
17 book *Lives of American Physicians and Surgeons of the Nineteenth Century*, which was actually edited by Gross and published in 1861 by Lindsay and Blakiston.[3] This time-honored title of father of American surgery was indeed well deserved and appropriately bestowed upon Philip Syng Physick.

Physick began from good stock, advanced his cause with Adam Kuhn, disciple of the famous Linnaeus, continued his journey with the greatest surgeon of the times, John Hunter in London and later in Edinburgh, and thereafter returned to Philadelphia, the most recognized and accepted medical center of the American continent. The result was indisputably the creation of the most distinguished surgeon yet seen on American soil.

References

1. Toledo-Pereyra LH, Shippen Jr W. Pioneer Revolutionary War surgeon and father of American anatomy and midwifery. J Invest Surg 2002; 15:183-184.
2. Malone D. Dictionary of American Biography. New York: Charles Scribner's Sons, 1934; 115:554-555.
3. Talbott JH. A Biographical History of Medicine. New York: Grune and Stratton, 1970:370-371.
4. Galishoff S. Physick, Philip Syng. In: Kaufman M et al, eds. Dictionary of American Medical Biography. Westport: Greenwood Press, 1984; 2:595-596.
5. http://www.ushistory.org/tour/tour-physick.htm
6. Rutkow IM. Philip Syng Physick (1768-1837). Arch Surg 2001; 136:968.

Chapter 18

John Syng Dorsey (1782-1818)

Luis H. Toledo-Pereyra

In November 1818, in the city of Philadelphia a rising and in many ways already distinguished surgeon was giving his introductory lecture on anatomy at the University of Pennsylvania. With extraordinary talent and dedicated preparation in the United States and abroad, and with the strongest support from the best of the new country's surgical leaders, he had accepted a position as professor of anatomy. Little did he know that at the age of 35, a fulminant and untreatable disease at the time, typhus, would take his life and negate his great potential for future accomplishments: this is the story of John Syng Dorsey (1783-1818).[1-3]

Dorsey, in spite of his young age, was well respected and appreciated by his contemporaries. "Extraordinary as were the powers of his mind, they did not surpass the qualities of his heart. He was born to be beloved". These were the powerful words that Professor Chapman utilized in his eulogy, delivered before the medical class of March 1st, 1819.[4] He went on to say, "As he lived, so he died; never shall I forget the truly impressive scene. When by his peremptory command the awful communication was made of his irrecoverable state, he was composed, firm and resolute, confiding in the mercy, and resigned to the will of Heaven. As a Christian, practicing with more than ordinary punctuality the duties of his religion, death had to him few terrors. Emphatically and with fervor did he reiterate the expression of his confidence in the atonement of his Savior, and the comfort which he derived from this source."

Dorsey was a true Philadelphian, born in the city where he received all his excellent elementary education at the school of the Society of Friends. He was well versed in the classics and enjoyed a great deal the accomplished masters of world literature. He demonstrated signs of conspicuous intelligence early and enhanced vivacity in the development of his tasks. When he was fifteen years old, he was accepted in the office of his uncle, the venerated Philadelphian professor of surgery, Phillip Syng Physick (1760-1833).[1-3] Here, under superb direction and dedicated attention, he was able to excel in the understanding of the most frequent medical and surgical problems of the times. "Medicine he cultivated with unusual ardor, and so successfully that, though by far the most juvenile member of the class, he had no superior in the estimation either of his teacher or fellow students."[4]

In the spring of 1802, in his nineteenth year, he graduated as a Doctor of Medicine from the University of Pennsylvania. He defended with high success his original dissertation thesis "On the Powers of the Gastric Liquor as a Solvent of the Urinary Calculi". He performed a series of well-conceived experiments to demonstrate his clear objectives. Immediately after his graduation and thesis defense, the devastating effects of yellow fever reappeared in the city of Philadelphia and with

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

dedicated fervor he applied himself to learning about the disease and its best treatment. Within a few months, he traveled to Europe to extend his knowledge in London and Paris, the most recognized centers of the medical world. He traveled, observed, wrote, analyzed and discerned the best ways to apply surgical principles to disease. He visited the venerable professors of surgery, the practical surgeons as well as those who had the most advanced treatments for surgical disease. He was accurate and incisive in his observations and delicate and sensitive in his criticism.[1-4]

In December 1804, he returned to Philadelphia after a successful professional and intellectual journey. He brought with him more knowledge, new thinking and the reputation of his experience with English and French surgical leaders of the time. In addition, he began in one of the most recognized surgical offices of the United States, that of his close and esteemed uncle Phillip Physick.[5] In medical practice, Physick gave him the nurturing support needed to solidify the essentials of treating surgical diseases, concepts Dorsey had recently acquired. After all, Physick had also been trained within the same principles of the European surgical masters. In particular, the name and practice of his dear teacher, John Hunter (1728-1793), deserved special recognition in the mind of professor Physick and his nephew John Dorsey. However, Dorsey did not have the opportunity to meet Hunter, who had died several years before he arrived to London, but his disciples had continued his teachings. In this case, John Abernethy (1764-1831) was the representative of the Hunter School in London. Abernethy had pursued the tradition of Hunter's teachings and the young Dorsey took advantage of any opportunities presented to him.[3,4]

In 1807, Dorsey joined the staff of the Pennsylvania Hospital and was elected adjunct professor of surgery at the University of Pennsylvania Medical School.[1] In 1810, he became a full surgeon at the same hospital. His talents of efficiency, dexterity and ingenuity in the surgical field were fully appreciated in this environment. With dedicated vision he advanced his interests in teaching, writing and the practice of surgery. In 1813, he was named Professor of Materia Medica and in 1818, Professor and chair of Anatomy at the University of Pennsylvania[1,4] after the passing of the respected professor Caspar Wistar (1761-1818), reputable surgeon and anatomist who had followed in the steps of William Shippen, Jr. (1736-1808), professor and founder of the department at the same university.[6]

As a surgeon, Dorsey had exceptional ability that was recognized by his professional peers. As a teacher, he had the patience and dedication to attend to his entire class. As a friend, he was loyal and supportive of all their causes. As a husband to Mary Ralston (April 30, 1807) he never failed in his obligations and was a source of support and understanding, and as a father to one son and two daughters, he offered the best of his love and caring guidance.[3,4]

One aspect of his enlightened life has not been addressed his commitment to writing about surgical sciences. In this pursuit, he was a beacon of productivity and exemplary force. He took the surgical lectures of his uncle, Phillip Physick and transformed them into the first systematic surgical textbook ever published in the new United States of America.[7] His book, *Elements of Surgery*, was published in 1813 in the city of Philadelphia by Edward Parker and associates. There were two volumes with 407 and 308 pages respectively.[7] He addressed general aspects of surgical importance, and specific areas of concern, such as, cancer, hernias, hydroceles, fistulas, aneurysms, abscesses, amputations, ulcers, congenital malformations, Cesarean surgery, uterine prolapse, bandages, sutures and opening of dead bodies.[7,8]

He addressed everything that was known at the time and his book represented the only book of the times!

The volumes contained 25 plates, eight of which were drawn by Dorsey, some in color, and all demonstrating great artistic talent. One of the plates depicted the first successful ligation of the external iliac artery, which he had performed in 1811.[7] Dorsey had his own appreciation of surgery as practiced in the United States: "An American, although he must belabour under many disadvantages in the production of an elementary treatise, is in one respect better qualified for it than an European surgeon. He is, at least he ought to be, strictly impartial, and therefore adopts from all nations their respective improvements". He recognized the considerable advances realized by British and French surgeons but he noted that "their deficiency in philosophick, courtesy and candour has in some instances greatly retarded its progress."[7,8]

John Dorsey contributed immensely to American surgery by transmitting to practicing surgeons the best that was available in the surgical arsenal of this young nation, as well as in the rest of the world. Our debt cannot be covered with a simple note of appreciation. We need to convey to current and future generations the way that the written record of surgical diseases and treatments evolved, the way that surgeons could learn in two volumes the essence of the profession, the way that surgery was fully conveyed to those interested in this promising field.

I am unable to finish this story without telling you the extraordinary opportunity I had few years ago to obtain a poorly preserved book, the two volumes of John Dorsey. It was a third edition, of 1823, marked by age, stains of coffee, probably wine and many other spirits. The pages were crumbling, but above all they preserved the original writings of Dorsey. The sensation of opening the book and going through its historical marks is indescribable and something that history converts would not have a difficult time in understanding and envying. This book represents the first American attempt to organize in writing the educational understanding of a recently established and new academic profession. John Dorsey's *Elements of Surgery* embodies his enormous desire to improve the level of surgical care and remains a monumental legacy to all of us.

References

1. Clark, John Yardley. Notes on the Lectures of John Dorsey. www.collphyphil.org/FIND_AID/C/clarkj10a_306.htm
2. Rutkow IM. Surgery, An Illustrated History. St. Louis: Mosby-Year Book Inc., 1993.
3. Talbott JH. A Biographical History of Medicine. New York: Grune and Stratton, 1970.
4. Chapman P. Dorsey John Syng Eulogium. In: Thacher J, ed. American Medical Biography. New York: Da Capo Press, 1967; 1:250.
5. Toledo-Pereyra LH, Phillip Syng Physick. Father of American surgery. J Inv Surg in press.
6. Toledo-Pereyra LH, Shippen Jr W. Pioneer revolutionary war surgeon and father of American anatomy and midwifery. J Inv Surg 2002; 15:183-184.
7. Rutkow IM. The History of Surgery in the United States. Textbooks, Monographs and Treatises. San Francisco: Norman Publishing, 1988.
8. Dorsey JS. Elements of Surgery. Vols. I, II. Philadelphia: Parker E, 1823.

Chapter 19

William Beaumont (1785-1853)

Luis H. Toledo-Pereyra

William Beaumont (1785-1853), American-trained physician and frontier military surgeon, learned medicine through an apprenticeship under Dr. Benjamin Chandler who believed in the European monistic theories that relied on a single cause for all diseases.[1] John Brown, Benjamin Rush, and William Cullen were Chandler's favorite intellectual mentors. The young Beaumont followed his master's lead, accepting the same medical mentors.

From Lebanon, Connecticut, where Beaumont was born, he ambitiously planned to reach new American territories. His schoolmaster-role model was Silas Fuller, who became a military surgeon and served in the War of 1812.[2] Beaumont departed Lebanon for Champlain, New York in 1807 to become the schoolmaster there. Two years later, he began reading under Dr. Benjamin Moore, who tutored him in medical matters until the beginning of his apprenticeship. In the spring of 1811, Beaumont entered a formal apprenticeship with Dr. Benjamin Chandler from St. Albans, Vermont. In June 1812, he was licensed by the Third Medical Society of Vermont to practice medicine "on the anatomy of the human body and the theory and practice of physic and surgery."[1]

At the age of 26, Dr. Beaumont signed on as a military surgeon with the U.S. Army. He was assigned to Plattsburgh, New York and attended the serious casualties from battles with the British in April 1813. Amputations of arms and legs and threphinations of fractured skulls were frequently performed by the young surgeon during this revolutionary war.[2] Beaumont left the Army in June 1815 and went into private practice in Plattsburgh for four years. In December 1819, he requested reactivation in the military and was assigned as a post surgeon to Fort Mackinac, on northern Lake Michigan. Beaumont found the hospital wholly unfit.[2] Lack of medical supplies characterized the standard of practice on this distant frontier.

June 6, 1822, represents an important and commemorative date in American medicine and surgery. On that summer day, French-Canadian voyageur Alexis St. Martin (1794-1880) unexpectedly appeared at Beaumont's door to receive medical attention for a massive, and, at first view, irreparable gunshot wound to the left upper abdomen. The injury affected part of the left lung, two ribs, and the stomach. Beaumont had no hope that the patient would survive. Furthermore, the treatment of the times was, under the best circumstances, rather primitive and unlikely to succeed. To Beaumont's great surprise, St. Martin fully recovered, though with an index finger-size hole in the stomach that never closed. This hole (gastric fistula) permitted food and other substances to be readily inserted into the stomach.[1-5]

Beaumont did not realize, at first, the great opportunity this injury presented for studying and more fully understanding human gastric physiology. By early 1823,

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

when St. Martin had fully recovered, Beaumont began to appreciate the special opportunity before him: the opportunity to study for the first time in the world the gastric physiology on a human being under direct vision; the opportunity, to recognize changes that had never been reported in the medical world literature; the opportunity to make medical history!

With unmatched diligence, Beaumont applied himself to uncovering the secrets of gastric physiology. From 1823-1833, on an intermittent basis and during various postings in Fort Mackinac, Fort Niagara (New York), Fort Howard (Green Bay, Michigan at the time), and Fort Crawford (Prairie du Chien, Wisconsin), Beaumont studied the gastric juice response as devotedly as allowed to by St. Martin's temperament. A final examination in Washington, D.C. culminated the Beaumont studies of Alexis St. Martin. Beaumont's unique observations were published in April 1833 in his long-awaited book, Experiments and Observations on the Gastric Juice and the Physiology a/Digestion, earning him a place in the annals of medical history.

From 1834-1839, Beaumont served his last Army posting in Jefferson Barracks near St. Louis, Missouri. He later entered a successful private practice in St. Louis. On April 25, 1853, a great surgeon scientist, the first in American medicine, passed away as a consequence of severe head injury after slipping on icy soil while leaving a patient's home. His body was buried in Bellefontaine Cemetery in St. Louis.[2]

Beaumont completely revolutionized the knowledge of gastric digestion with his 238 experiments on the human stomach. He accurately described the movements of the stomach during digestion, the presence of gastric juice after food was introduced, the existence of hydrochloric acid (aided by Dr. Robley Dunglison from the University of Virginia), and the effects of gastric secretion upon various food elements.[6]

Three important factors, at least, contributed to Beaumont's superb accomplishments: the accidental occurrence of the gastric fistula on Alexis St. Martin, the tenacity of Beaumont's creative spirit, and the fortunate and willing assistance received from the unselfish Surgeon General Joseph Lovell. Within a few years after the publication of Beaumont's 1833 classic, his work was highly appreciated in European circles. His first American edition was edited for distribution in Germany and England. Beaumont was on the mind of Europeans and scientists worldwide as the first American surgeon scientist of international reputation. Beaumont stands as the first surgeon-scientist of American descent and certainly one of the first in the world.

References

1. Horsman R. Frontier Doctor. William Beaumont America's First Great Medical Scientist. Columbia: University of Missouri Press, 1996.
2. Life of Dr. William Beaumont, http://www.james.com/ beaumont/drJife.htm.
3. Beaumont, William. The Columbia Encyclopedia, 6th ed. New York 2001.
4. Myer JS. Life and Letters of Dr. William Beaumont. St. Louis: CV Mosby, 1912.
5. Numbers RL, Orr Jr WJ. William Beaumont reception at home and abroad. Isis 1981; 72:590-612.
6. Duffy J. The Healers. A History of American Medicine. Urbana: University of Illinois Press, 1976.

Chapter 20

Paul Broca (1824-1880)

Scott E. Cowie

The role of Paul Broca (1824-1880) in uncovering the cerebral organization of language function is well known. His declaration, made after considerable clinical study that "we speak with the left hemisphere" has justly resulted in the eponymous naming of the left inferior frontal lobe.[1] Less well known, however, are the contributions that Paul Broca made as a surgeon of the brain. These included methods for the scalp localization of cerebral convolutions, thermoencephalography, and, in 1871, the first craniotomy made on the basis of a localization of cerebral function.

Broca was born in a small French town, in the same decade that produced Lord Lister, Louis Pasteur, Herbert Spencer, Charles Baudelaire, and Johann Strauss. Broca's father was a physician who encouraged his son's entrance into medical studies at the College Sainte-Barbe in Paris. Broca, excelling in the competitive Parisian medical system, eventually became the youngest Aide in anatomy at the age of 22. At 24 Broca found himself providing surgical care as well as sentry duty at the Hotel-Dieu during and in the aftermath of the Revolution of 1848.[2] Following this was a long career in the various fields of anatomy, ethnology, pathology, and neurology. However, Broca was first and foremost a surgeon, and in 1865 was elected president of the Paris Societe de Chirurgie. Like many surgeons in the nineteenth century, Broca made numerous contributions to knowledge about the human body. The most important of these was a diagnostic accomplishment involving a case of an extradural abscess.

In June 1871, a 38-year-old laborer presented himself to Broca's La Pitie clinic after receiving a kick in the left fronto-parietal region from a horse. Despite the lack of fracture, 1 month later the patient worsened and began to show signs of aphasia, responding to all questions only "It is not going badly." After some time the patient lapsed into full aphasia and then into coma. Broca began his operation by marking out a point 5 cm horizontally and 2 cm superiorly from the orbital process. He then trephined and evacuated the abscess overlying "the cerebral organ of language."[3] Despite the attentions of Broca and the chief resident, which included further cerebral exploration, the patient became comatose 11 hours postoperatively, and subsequently died. An autopsy revealed early suppurative involvement of the inferior frontal gyrus.

It is evident from Broca's account of this case that he was aware of the fundamental neurosurgical principles that the operation established. The reasoning behind his suspicion of the abscess's location was derived from his earlier investigations of the cerebral functional areas. These investigations were part of a broader scientific and cultural movement that gradually dismantled the concept of *asensorium commune* or common pool of psychic functions in the brain. Theories formed in

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

the 18th century had postulated that this seat of the soul lay variously in the ventricles, corpus callosum, or cerebral association tracts.[4] By 1861, when Broca had submitted his thesis to the Anthropological Society of Paris concerning the loss of the speech faculty following a confined cerebral lesion, both the scientific and public imagination had been well prepared by the researches (and pseudoscience) of Gall and the phrenologists to accept the idea that the brain was a collection of distinct functional regions. Broca's surgery was a logical application of these principles and observations.

As a professor of surgery, Broca continued to develop other methods to allow accurate localization of cerebral lesions prior to craniotomy. He invented some 27 instruments to determine the relationship of brain and skull. These included the goniometer, craniograph, and other types of stereographic equipment.[5] Another avenue of research that Broca was able to apply clinically was that of the recently discovered significance of body temperature in disease, developed primarily through the work of Carl Wunderlich published in 1868. Broca's own work on the surgical treatment of aneurysms had shown that there was a rise in local temperature following an increase in blood flow.[6] He then developed a "thermometric crown," which used a ring of six insulated mercury vessels to identify areas of recent infarction and to guide the decision to operate in cases of fracture.

Broca was a man of many interests and much influence. He was the first to assert that trephination was an ancient therapeutic practice that had allowed those subjected to it to survive postoperatively, as evidenced by signs of inflammation on the cranial wound margins. His contributions to anthropology, particularly its archaeological and physical branches, are well known to those in these fields. Broca was an elected Senator, and a renowned lecturer. It was at the age of 56 that he died.

References

1. Broca P. Surle siege de la faculte du langage articule. Bull Soc Anthropol 1865; 6:377-393.
2. Schiller F. Paul Broca. Founder of French Anthropology, Explorer of the Brain. Berkeley: University of California Press, 1979.
3. Broca P. Diagnostic d'un abces situe au niveau de la region du langage: Trepanation de cet abces. Rev Anthropol 1876; 5:244-248.
4. Walker A. The development of the concept of cerebral localization in the 19th century. Bull Hist Med 1957; XXXI(2):99-119.
5. Garrison F. An Introduction to the History of Medicine. 4th ed. Philadelphia: WB Saunders, 19:493.
6. Broca P. Des aneurysmes et de leur traitement. Paris: Labe et Asseslin, 1856.

Chapter 21

Joseph Lister (1827-1912)

Jason R. Francoeur

Joseph Lister was not the first surgeon, nor was he the first scientist; in fact, he was not even the first man to do both. Lister was, however, the first man to show tremendous strengths in both fields and combine them into one occupation—the surgeon—scientist. Joseph Lister's broad surgical skills, his inquisitive nature, and above all, his receptivity to new and foreign ideas directed him toward one of the great discoveries introduced to mankind.

The mid-nineteenth century would be a turning point for the profession of surgery. Accomplishments that may seem trivial to the modern-day person were being achieved in the world of medicine. Perhaps one of the most significant of these was the discovery of chloroform as an anesthetic by James Simpson in 1847. This discovery, along with the use of nitrous oxide by Wells and of ether by Morton, paved the road to further surgical advancements by taking one of the two great fears of surgery out of consideration, that of pain. This was fully realized in 1846, when John C. Warren in Boston and Robert Liston in London first performed surgery on an anaesthetized patient. The other great fear of surgery was surviving the procedure only to succumb to wound sepsis postoperatively. It is important to acknowledge the importance of anesthesia with regard to Joseph Lister, in that anaesthesia increased the number of surgeries being performed exponentially, and with this rise, a parallel increase in wound sepsis occurred. It was this conflicting world that Lister entered, and he left a legacy worldwide.

Joseph Lister was born in Essex, England, to a wealthy Quaker family. His father was a wine merchant who had keen interests in science and experimentation, especially optics. The senior Lister's experiments would eventually lead to dramatic improvements in the microscope and to the invention of the achromatic lens. For this contribution, Lister's father was granted membership in the Royal Society of Fellows. Lister's mother was a schoolteacher, and her teaching enabled Lister to excel at his studies. His tendency toward diverse interests and his innate curiosity, traits that enabled Lister to become the surgeon he did, seemed to be characteristics that both his parents shared. Lister was an adept artist, and his father had hoped he would pursue this field. Lister had different ideas, however, and biology had always owned his heart. At a young age, Lister dissected fish and small animals, and he proclaimed quite precociously that he would one day be a surgeon.

At age 17, Lister entered University College, London, to study for his Bachelor of Arts degree. He continued at University College and entered the medical school in 1848. After demonstrating tremendous promise and accumulating several awards, Lister gained his Bachelor of Medicine degree in 1852, and entered into a surgical internship at the infirmary that year. Lister had been training in London for only

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

a short time, but he had already demonstrated his propensity for scientific experimentation. Lister had always been interested in the process of wound inflammation and healing and the mysteries behind wound suppuration. He examined the damaged tissue at a microscopic level, something few of his peers contemplated in this period.

Lister was encouraged to travel to Edinburgh, Scotland, in his first year of training to work for a month or so with the famous Dr. James Syme. Lister consented and went to work at the infirmary in that city. He worked with Syme on the Male Accident Ward, and here again he was confronted with the mysteries of wound suppuration. Lister questioned the etiology of this endemic misfortune of surgical patients. At the time, it was thought that wound sepsis and its deadly siblings pyemia, erysipplas, and hospital gangrene were due to elements in gases of the air—the contagions and miasmas. Wounds were tightly dressed to prevent the air from contaminating these breakdowns in the skin. It was during this time that Lister considered the fact that patients with closed fractures with no skin damage did well and rarely, if ever, contracted wound sepsis. On the other hand, those with open fractures almost inevitably were afflicted with the deadly infections. Lister reasoned that the elements responsible for suppuration were entering through the skin breakdown, and from this speculation he would spend the next decade trying to control wound infections.

Dr. Syme was a well-known and competent surgeon, and he kindly took the young Lister into his home and treated and educated the young surgeon as if he were of Syme's own family. Lister did in fact become family, as he married Syme's eldest daughter, Agnes. Lister and his new bride would become a formidable team, as she was a firm believer in her husband's goals and theories and she drove him to succeed with experimental assistance, words of encouragement, and unfailing support.

Though comfortable in Edinburgh, Lister moved to Glasgow in 1860 to accept the position of Professor of Surgery at the university. In Glasgow, Lister had a private practice, surgeries at the infirmary, and the additional responsibilities of instructing medical students. Lister was incredibly busy and kept a schedule familiar to surgeons of today. Despite all of his commitments, he continued to explore wound sepsis. Lister still felt that wound suppuration resulted from agents in the air, and he felt that in order to stop wound infections he must destroy these agents that had gained access to the wound and also must prevent subsequent invasion into a healing wound.

In 1865, as the Civil War ended in the United States and thousands of men would continue to die of wound sepsis in the new world, a chemist at Glasgow University, Professor Anderson, approached Lister and informed him of a Frenchman's experiments with the fermentation process. Louis Pasteur had demonstrated that fermentation resulted from the action of small microbes. These microbes were in the air and could "fall" into any appropriate media and replicate and cause fermentation. Pasteur demonstrated that it was not the gases in the air but these microbes that were responsible for fermentation. Lister took this astounding piece of information and made one of the grandest leaps of knowledge known to humankind. Lister reasoned that fermentation was similar to wound suppuration and perhaps these microbes were responsible for wound suppuration. In addition, the open wounds were exposed to air and inevitably became septic, but the closed wounds did not as they were not exposed to the floating microbes. Reaching further, Lister noted that an engineer, Crooks in Glasgow, had removed the smell from the sewage, which was thought to be due to fermentation, by adding carbolic acid to the sewage. Lister, having come full circle in his mind, reasoned that the application of carbolic acid to wounds might prevent wound sepsis. He set out at once to prove his theory. Using a time-consuming but effective method of dressing wounds with materials soaked in carbolic acid and sealing these dressings with tin foil, Lister managed to reduce surgical wound sepsis to minimal amounts over the next year. He encountered several setbacks in his attempts to manage these wounds, one of the greatest being the tissue damage that occurred as a result of contact with carbolic acid. Lister worked diligently to construct the perfect method, and he enjoyed great success in Glasgow. After the initial defeat of the microbes, though, Lister had to conquer an even greater foe, his surgical contemporaries.

In the 1860s, wound suppuration was thought to be an evil but unavoidable consequence of surgery, as it was simply the fate of the surgical patient. The doctrines of miasmas and wound suppuration by air contamination were well instituted. An obstetrician named Semmelweis had shown with amazing clarity the benefits of hand washing in the 1840s, but the respected physicians of the time, including Professor Virchow, dismissed him as a heretic, and he unfortunately never convinced the medical world of his findings. Lister proved to be a more formidable foe, however, and with the findings of other surgeons and scientists, his theories gained undefeatable momentum. With consistent experimentation and constant letters and journals to The Lancet, Lister steadfastly explained his methods and won support throughout the continent except in England. Germany used antiseptic techniques in almost all of its hospitals and had great success. The old surgeons of England managed to sustain a gallant if ignorant fight, however, stating that the thought of microbes was absurd, especially as Lister himself could not prove their existence.

In 1877, a young German doctor,Bobert Koch, made an instrumental discovery that forever turned the tide in favor of antisepsis. Koch was able to demonstrate that the microbes that Pasteur demonstrated in the air did exist (!) and that there were

different kinds. He was able to demonstrate that infected sheep's blood grew tiny organisms shaped like rods that he named Bacillus anthrax, and these organisms in turn could be used to infect other sheep by direct contact. Furthermore, these microbes were susceptible to heat. Koch also noted round structures that were not as susceptible to heat; these he termed spores, and given the proper conditions these spores would begin to divide into the rods. This discovery filled the hole in Lister's reasoning. Lister postulated that microbes were in the wound but he never visualized them, but Koch now had! In addition, Koch's findings enabled a young German surgeon, Dr. von Bergmann, to demonstrate that these microbes could come from the patient's skin, the surgeon's hands, or even the surgical instruments. In addition, von Bergmann's assistant Dr. Schimmelbusch demonstrated that heating the surgical instruments would kill any microbes present. With these advancements, antisepsis slowly spread worldwide. The poor English patient continued to suffer, however, as the surgical establishment of London wallowed in ignorance. Lister did not give in, and in 1877 he went to challenge his foes directly by accepting the Chair of Clinical Surgery at King's College, London. His appointment was met with much opposition, but Lister felt he needed to be in London to implement his approach. Amid much ridicule, including open mockery from medical students, Lister introduced antisepsis to the surgery ward, removing the smell of wound sepsis and detractors to his theories. Soon England would join the rest of the world in realizing that antisepsis saved lives.

During the years that Lister fought for recognition of antisepsis, he used the technique to advance many surgical procedures and to attempt several procedures that before antisepsis might have been considered malpractice. After treating open fractures with his carbolic acid dressings, Lister performed the first operation with his antiseptic techniques, the drainage of a psoas abscess. Traditionally, these abscesses were certain death sentences with or without surgery, but Lister's patient survived and recovered without sepsis. He modified amputation techniques, including using a high dissection method for hip dissections, which avoided the hip itself. He opened and drained infected joints. He had success with breast cancer resections and was able to advance well into the axilla and pectoralis major fascia without resulting infection. Lister revived suprapubic cystotomies. He attempted carbolic acid injections as a treatment for varicose veins, varicoceles, and vascular tumors. He developed several instruments, including hooks for extracting foreign bodies from ears, aortic tourniquets, sinus forceps, and wire needles. He also developed many dressings, wound drains, and of course his work with ligatures. Lister experimented with catgut sutures and found that sterilizing them in carbolic acid and cutting them short to the knot would prevent infection, and by using them in calves, he demonstrated that they were dissolved by 30 days. To increase the duration of their existence, Lister treated the catgut ligatures with chromic, thus creating the chromic catgut suture. Lister washed his hands and treated patients' skin with carbolic acid before surgery, and continuously sprayed the surgical field with carbolic acid. Lister's approach was one of antisepsis, but his methods did border on asepsis, although his contemporaries in Germany were well ahead of him in this regard. By 1884, Lister had increased his antiseptic armamentarium to include eucalyptus oil, iodoform, salicylic acid, and corrosive sublimate. Lister was described as a cautious, deliberate, and thoughtful surgeon who approached each procedure with a definite plan. His approach to surgery was very similar to his approach to science; he did not like surprises and used very calculated techniques to ensure success.

Joseph Lister's ideas were not perfect. In fact, many of his carbolic acid mixtures were damaging to both the wounds of the patients and the hands of the surgeons who now washed their hands in carbolic acid before surgery. Lister's idea of spraying the wound during surgery also fell out of favor, with the results obtained from the discoveries of Koch, von Bergmann, and Schimmelbusch. Here Lister's greatest strengths came to light, however. Lister was the first to condemn his method of spraying wounds as frivolous, and openly supported the new tactics of steam heating or chemically treating instruments, cleaning patients' skin, and most importantly cleaning surgeons' hands. Lister's modesty, humility, and ability to accept new ideas and dispose of those that were wrong may have been his most important attributes. Lister accepted Pasteur's ideas as correct without even meeting the man, and was always certain to credit Pasteur to his surgical peers, even though many had never heard of the man. Lister examined Pasteur's experiments, saw them as sound, and accepted their results. In regard to some of his own failures, he simply accepted that they were just that and set out to erase the mistakes. It was often noted that Lister consistently had many bandages on his arms. How could such a gifted surgeon be so clumsy as to have so many wounds? The bandages turned out to be soaked in different chemicals and concentrations. Lister was simply trying to find the right balance of antiseptic solution that would not irritate the skin. He was the curious scientist, the skilled clinician, and the dedicated husband. He truly embraced the scientific world, openly acknowledged its doctrines, and worked to incorporate them into the field of surgery. His willingness to look beyond the accepted and embrace the experimental made him a great surgeon, and his pioneering efforts in antisepsis will be remembered as a great contribution to humankind.

References

1. Cameron HC, Joseph Lister. The Friend of Man. London: Heinemann, 1949.
2. Thorwald J. The Century of' the Surgeon. New York: Pantheon, 1956.
3. Turner AL. Joseph, Baron Lister Centenary. Edinburgh: Oliver and Boyd, British Medical Association, 1927:1827-1927.
4. Wellcome Historical Medical Museum. Lister Centenary Exhibition Handbook. London: Wellcome Foundation, 1927.
5. Zimmerman LM, Veith I. Great Ideas in the History of Surgery. New York: Dover, 1961.

Chapter 22

Theodor Billroth (1829-1894)

Herman Kwan, Rod McLaren and Todd Peterson

Theodor Billroth is quite possibly one of the most remarkable surgeons of the 19th century. It was clear that he believed in the adage that art and science were created from the same source. While he has left us a legacy of surgical procedures and publications, more notable was his gift of spirit and his ability to inspire his pupils: "We go up the steps to gain on each step a new view. Even for the most clever climber there is always enough of the ladder left to climb, the end of which reaches into the clouds."

Theodor Billroth was born April 26, 1829, on the Island of Rugen on the Baltic Sea. He was the eldest son of a German mother and a Swedish Lutheran pastor by the name of Karl Theodor Billroth. At the young age of 5, Billroth lost his father to tuberculosis. Following this loss, his mother and he relocated to Greifswald, where Billroth began his schooling. Billroth was well known for his immense passion for music. His initial musical interest was fostered by a deep family rooting in the musical arts. Over a relatively short time he developed into a gifted organist and violinist. Inspired by his own talent and musical heritage, Billroth initially set out to study music, with no intention of pursuing medicine. However, due to financial reasons and the persuasion from a family friend, Wilhelm Baum, a distinguished professor of surgery, Billroth entered medical school.

Under the influence of his outstanding professors, the once inattentive student was transformed into an extremely dedicated worker. Wilhelm Baum, who was instrumental in convincing Billroth to attend medical school, later joined him at the University of Gottingen. Despite his continued musical interests, both Baum and Rudolf Wagner, a professor of physiology, helped ensure that Billroth focused on his medical studies. In 1851, he studied the histology of the origin and endings of nerves under Meissner and Wagner in Trieste. He completed his final year of medical training in Berlin and received his doctorate in 1852. In this final year of training, Billroth was to perform his first operation: a herniotomy. That year he undertook his state medical examinations (which he deplored) and served his compulsory term with the army.

In early 1853 he traveled to Vienna, where he took courses under Hebra, Heschel, and Oppolzer. This trip was cut short, however, as he learned his mother died. He later traveled to Paris and spent several weeks with Baum and Meissner. During his repeat trip to Vienna that year, the second Viennese medical school had come to fruition. This school had members of high esteem: Rokitansky, Hyrtl, Hebra, Oppolzer, and Skoda. Billroth stayed in Vienna for several months to receive instruction from these significant medical figures. He later returned to Paris,

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

where he was introduced to many aspects of surgery, namely, academic, clinical, and scientific practices.

Early in his career, Billroth opened a general practice in Berlin. Working as one of the physicians for the poor, Billroth found the position offered neither security nor definitive medical results in which patients were effectively treated and cured. This venture failed shortly after, lasting only 2 months. Following this, he applied for an assistantship under Bernard Von Langenbeck, Germany's great surgeon and educator, and was accepted 14 days later.

Langenbeck was quick to recognize Billroth's surgical ability and intellectual talent. Billroth lived in the clinic and was in charge on the female ward, where he gained experience in many day-to-day surgical procedures. At night he would spend hours studying slides and discussing his findings with Meckel, a man who greatly influenced Billroth's interest in histology and surgical pathology. During the years of work in the Langenbeck clinic, Billroth published many papers including the comparative histology of the spleen, the structure of mucous polyps, the development of blood vessels, cysts of the testicles, tumors of the parotid, fibroid tumors of the maxilla, and tumors of the breast. At the early age of 25 years and after 3 years of study with Langenbeck, he qualified as university lecturer in surgery and anatomic pathology.

To add to his life experience, he met a woman named Christel Michaelis, whom he later married in 1858. Also during this year, with the impending outbreak of war between Prussia and France, Billroth prepared himself by writing a historical account of the nature and treatment of gunshot wounds.

In 1860, at the age of 31, Billroth was appointed professor of the surgical clinic in Zurich. Originally this position had been offered to, and accepted by, Nussbaum, a professor of surgery in Munich. Nussbaum was well known for his work in corneal transplantation and antisepsis. Later, however, Nussbaum declined the position, feeling immense academic and clinical pressure in Munich. With continued pressure from the Zurich school, Billroth reconsidered. With the new position, Billroth dedicated significant time to lecturing, and to investigation of wound disease and prevention. Through his study, he noted that the mere presence of a wound does not necessarily imply resultant development of disease. Rather, a further factor must be accounted for, which Billroth described as the "accidental disease of wounds." With the little knowledge available on infection, he hypothesized that bacteria might be responsible for wound disease. This hypothesis, an idea that was much ahead of its time, was later substantiated by Lister's work.

During his Zurich years, Billroth published his classic textbook on surgical pathology and therapy. This book, entitled *General Surgical Pathology and Therapy in 50 Lectures,* brought him worldwide acclaim. However, his most remarkable work, and possibly one of the more significant contributions to medicine, was his statistical account of his Zurich years. Billroth undoubtedly realized the importance of the statistical method in evaluating surgical versus conservative treatment. "This is how we ought to work—if clinical experience is to add to medical knowledge," Billroth exclaimed. In 1869, Billroth published *Surgical Clinics of Zurich 1860-1867,* which was a compilation of reports on patients he had operated on during this time. In keeping with his belief that a surgeon must be able to quote his therapeutic experiences statistically, this report had a heavy statistical emphasis.

Despite the demands of his medical practice, Billroth's love of music continued unrelentingly. While in Zurich, he met Johannes Brahms, with whom he developed a lifelong friendship. Interestingly, two of Brahms's string quartets were dedicated to Billroth. Billroth was also a personal friend of Strauss.

In 1867, Billroth was appointed chair of surgery at the University of Vienna. This was the year when Joseph Lister published his first paper, in *The Lancet,* on the antiseptic principle in surgery. Lister believed that wound infection was related to bacteria. He promoted the use of carbolic spray and dressings after surgery to prevent infection. Billroth's attitude towards "Listerism," which was rapidly introduced into German and Swiss clinics, was at first rather reserved. He felt that a scientific basis for the excessive antiseptic prescriptions was lacking. Years later, however, convinced by the comparative statistical work of Pasteur and Koch, Billroth became one of the foremost proponents of antisepsis and asepsis on the continent.

When reflecting on his accomplishments, Billroth believed that one of his greatest contributions was the creation of his surgical school in Vienna. He said, "The greatest joy in my rich life was the founding of a surgical school that carries on my aims of scientific and humanitarian accomplishments." Billroth had the unique ability to inspire his pupils. This is what made him a great teacher. At his first lecture in Vienna, he told the students, "You, gentlemen, must do most of the work. The future of the school of learning is founded on the work of its pupils, as the future of the state is on the work of its citizens." Later he said, "A human organization can endure only if it progresses as the total cultural development does. To keep our position means always to progress, always to create, and to advance more than others. Everyone who stands still will be passed by with mercy." Billroth was extremely devoted to his students and, given his research interests, insisted that they publish their own experiments.

On January 29, 1881, Billroth performed the surgical achievement for which he is most often remembered, the first successful gastrectomy in a human. The patient was a 43-year-old woman named Therese Heller, who had developed a carcinoma of the pyloric and antral regions. Billroth resected the lesion and was able to anastomose the gastric remnant to the duodenum. It was recorded that the operation including anesthesia and lasted hours. The patient survived for 4 months and eventually died of metastatic disease. Billroth developed the Billroth I operation, an antrectomy with gastroduodenostomy, while doing experiments on dogs. Later in 1884, Billroth began performing the Billroth II, resecting the pyloric antrum and joining the remnant to the jejunum. Two years later, his assistant Von Mikulicz performed the first pyloroplasty. Indeed, the 5 years from 1881 to 1886, since Billroth's first resection, were very unusual in that five of the common procedures in use today were all done in that remarkable half-decade. Billroth's other notable contributions include perfecting the tracheostomy and performing the first laryngectomy in 1873, performing the first esophageal resection in 1877 with student Vincenz Czerny, and experimenting with mastectomy and axillary dissection for breast cancer in 1880, 14 years before Halsted introduced the radical mastectomy.

Billroth's achievements span his role not only as a surgical innovator, but as a teacher and researcher as well. In 1875 he completed *The Medical Sciences in the German Universities,* a work that outlined and examined the entire spectrum of medical education, including curriculum and faculty selection, licensing, examination, and the teaching of scientific principles. In this work, Billroth noted that "A person may have acquired from books a vast amount of medical knowledge, he may have even memorized from the books the technique of its application; such a person has much knowledge of medicine, and yet with it all he is no physician. He must see and hear a master's diagnosis, prognosis, and treatment of disease. He must witness the master's skills in action, in order himself to become a practitioner." The emphasis on scientific objectivity and clinical experience gained through long study under a "master" was included in Billroth's concept of surgical training.

While he was in Vienna, Billroth's fame prompted several visits from prominent American surgeons. In America, academic programs for the education of surgeons were yet to be established. As his fame spread, Billroth noted the sentiments of many present-day physicians: "My strength is leaving me, yet the demands of people for what I can give increase."

Later in Billroth's career, he rejected the opportunity to succeed Langenbeck, following his retirement, in Berlin. Probably this was not only because of the professional challenges, but due to Billroth's extensive involvement in, and love for, Vienna's social and artistic life. Nonetheless, Billroth received many honors for his work, including appointments as Imperial and Royal Aulic Councilor and Professor, President of the Imperial and Royal Medical Association of Vienna, and appointment to the Austrian House of Lords.

Billroth's later years were plagued by physical illness. In 1887, he was struck by severe pneumonia, with cardiac and respiratory complications, from which he never completely recovered. He would regularly treat himself with "digitalis and other poisons." Ironically, the very complication that he earned his doctorate on, the nature and cause of pneumonia caused by cervical vagotomy (1852), eventually took his life. Billroth died on February 6, 1894, in Abbazia while working on his book *The Physiology of Music.* He now rests in the Central Cemetery in Vienna.

References

1. Absolon KB. Theodor Billroth's formative years (1829-1894). A study in memory of the subject's 150th birthday. Am J Surg 1979; 137(2):394-407.
2. Absolon KB. Theodor Billroth: The making of a surgeon. Surg Ann 1978; 10:417-441.
3. Allgower M, Trohler U. Biographical note on Theodor Billroth. Br J Surg 1981; 68(10):678-679.
4. Billroth TA. Autobiographic sketch of himself by TA. Billroth. Am J Surg 1978; 135(5):696-699.
5. Browne H. Theodor Billroth—Surgical pioneer. Irish Med J 1981; 74(1):2.
6. Roses DF. On the sesquicentennial of Theodor Billroth. Am J Surg 1979; 138(5):704-709.
7. Rutledge RH. In commemoration of Theodor Billroth on the 150th anniversary of his birth. Billroth I: His surgical and professional accomplishments. Billroth II: His personal life, ideas, and musical friendships. Surgery 1979; 86(5):672-693.
8. Rutledge RH. Theodor Billroth: A century later. Surgery 1995; 118(1):36-43.

Chapter 23

Theodor Kocher (1841-1917)

Robin Kennie

Most people know of the name Theodor Kocher due to using the forceps or incisions he is known for. What most do not know is that he was the first surgeon to win the Nobel Prize in Medicine/Physiology and, for over 50 years, the only one.

Theodor Kocher was born in Berne, Switzerland, on 25 August 1841. He went to medical school in Berne, from which he graduated in 1865. Dr. Kocher trained in surgery under many great surgeons, including one of the most famous of his day, Theodor Billroth, and in 1872 was appointed as a Professor of Surgery at the University of Berne. Kocher was known as a serious and studious man. He was interested only in medicine and received top honors during his medical school career. He married and had three sons, and was known by some to have a keen sense of humor, although it was never seen in the operating room. While he was very meticulous about his work, he also displayed a very warm attitude toward his patients. All of these traits suggest that he was indeed suited to his chosen field.

In Kocher's day, Berne was known as an area where many people were afflicted with goitre due to the lack of iodine in the water and food supply of the area. Besides the unsightly aspect of goitre, the increased mass of the thyroid caused undue pressure to be put on to the trachea of the unfortunate individual. Dr. Kocher was very much immersed in the battle against goitre, with his first operation on the thyroid being attempted in 1872. Dr. Kocher was a very exact surgeon and he perfected the removal of the thyroid gland. He was able to remove all of the thyroid tissue without removing the parathyroid glands, while leaving the (now known) recurrent laryngeal nerve intact, and minimizing the loss of blood.

While Kocher was the most thorough and exact surgeon removing goitres at the time, there were also other surgeons performing the procedure. One of these surgeons was Billroth. He was also known as a great surgeon but not as exacting in thyroid removal as his pupil, Kocher. During many of his procedures, he would end up removing the parathyroid glands and, in many cases, left pieces of thyroid within the patient. This difference is significant because of the consequences Kocher saw his operation having on his patients.

Although Billroth's patients usually functioned normally after the operation, Kocher found that "removal of the thyroid gland has deprived my patients of what gives them human value. I have doomed people with goitre, otherwise healthy, to a vegetative existence. Many of them I have turned to cretins, saved for a life not worth living."[1] Kocher was so devastated by the realization that he was causing more harm than good, that he began extensive research on what he termed cachexia strumipriva, which we now would call operative myxedema. Kocher began to investigate the patients that he had previously performed thyroidectomies on and found

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

that a significant minority of his patients a few months after surgery were showing signs of tiredness, mental slowing, memory lapses, and cool skin. These afflicted patients had in common the fact that no thyroid tissue was left behind after the operation. He found, on the other hand, that when small portions of the thyroid were left behind after the operation, the gland had the ability to regenerate and patients were seemingly normal. Upon this realization, Kocher vowed that he would never again perform an operation where he removed the entire thyroid gland.

Kocher was not the first person to observe the connection of cretinoid characteristics with abnormalities in thyroid function; others, including Plater, Paracelsus, Curling, Gull, and Ord, had linked cretinism with goitre and thyroid deficiency. Kocher's observations, though, brought all the previous knowledge on the function of the thyroid gland together. Kocher was able to prove that hypothyroidism can be caused by the lack of glandular material and also that it can be caused by a lack of function of present thyroid tissue. Due to the work of Kocher, others were able to treat patients with the products of the thyroid gland in order to treat deficiencies.

Kocher's great contribution to the understanding of the thyroid gland was not so much in his great skill as a surgeon, but rather in his refusal to accept the results of the surgeries as normal. His commitment to research and his desire to educate others were of great importance. This commitment was acknowledged with a well-deserved Nobel Prize. As a surgeon, Dr. Kocher lived by a rule that stated, "a surgeon is a doctor who can operate and who knows when not to."[1] It is this rule that indeed made him the "Noble Surgeon."

References

1. Hager K. The Illustrated History of Surgery. London: Harold Stark, 1988.
2. Nobel Foundation. Nobel Lectures, Physiology or Medicine. New York: Elsevier, 1967; 1901-1921.
3. Riedman SR, Gustafsen ET. Portraits of Nobel Laureates in Medicine and Physiology. Toronto: Abeland-Schuman, 1963.
4. Stevenson LG. Nobel Prize Winners in Medicine and Physiology, 1901-1950. New York: Henry Schuman, 1953.

Chapter 24

Charles McBurney (1845-1913)

Vincent Thien

Major advances in the field of surgery took place near the end of the 19th century. These advances were spurred in part by Lister's development of the aseptic surgical technique, which now gave surgeons the opportunity to enter the peritoneal cavity safely with less fear of post-operative infection. One surgeon in particular who took full advantage of this opportunity and dramatically advanced the field of surgery was Charles McBurney.

Charles McBurney was born on February 17, 1845 in Roxbury, Massachusetts. He attended Boston Latin School, received an A.B. and M.A. degree from Harvard University and then studied at the College of Physicians and Surgeons in New York, receiving his Medical Degree in 1870. Following his internship, McBurney traveled abroad to Europe for postgraduate studies (to Vienna, Paris and London). He later returned to the United States working at various New York Hospitals for the next fifteen years. At the age of 43 years, McBurney was appointed the Chief of Surgery at Roosevelt Hospital in New York, a position he would hold for the next 12 years while making a name for himself and making this hospital a 'Mecca' for surgeons from around the world.

Throughout his surgical career, McBurney achieved a balance between clinical and academic pursuits. Clinically, McBurney was renowned throughout New York for his impressive surgical skill in standard operative procedures. Academically, McBurney was well known for his written compositions and numerous publications (over 100 papers). The surgical disciplines of Neurosurgery, Orthopedics, and General Surgery were all areas to which McBurney contributed academically, writing articles on various surgical approaches and techniques. For example, in the field of neurosurgery, McBurney was the first person to remove a true cerebellar tumor (cystic) from a patient, in 1893. In orthopedics, he described management approaches for dislocation of the humerus complicated by fracture. He also contributed to the field of aseptic surgical techniques by taking Halsted's advice in using surgical gloves. McBurney later published articles attesting to the decreased incidence of post-operative wound infections in his surgical practice following the routine use of rubber gloves in all of this operations.

Despite the recognition that he received as one of New York's most talented surgeons, in addition to his contributions to other surgical disciplines, Charles McBurney is still remembered best for his work in general surgery particularly for the management of appendicitis. It may therefore be surprising for some individuals to learn that McBurney was not the first person to perform an appendectomy, nor was he the first to use the term 'appendicitis'. Instead, it was a

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

surgeon named Claudius Amyand, who in 1736 performed the first appendectomy, and it was a pathologist named Reginald Fitz who in 1886 (one hundred and fifty years later) described the clinical features and pathophysiology associated with an inflamed/obstructed appendix. It was also Fitz who first used the term 'appendicitis'.

In addition to Fitz and Amyand, numerous others performed appendectomies and contributed to the treatment of appendicitis before Charles Mc-Burney's time (e.g., Parker, Hancock, Tait, Morton). However, it was Charles McBurney who ultimately revolutionized the way appendicitis was managed and thus it is his name that is so often used in association with this condition.

McBurney made contributions to both the diagnosis and treatment of appendicitis. Although Reginald Fitz first described the pathophysiology and clinical symptoms of appendicitis, it was McBurney who refined the description of clinical symptoms and later went on to describe one of the best known 'signs' in surgery still frequently called McBurney's Point. This is the point of maximal tenderness when the abdominal wall is pressed with one finger, and it is a good localizing sign in appendicitis. He described the location of this area in an 1889 paper "very exactly an inch and a half to two inches from the anterior spinous process of the ileum on a straight line drawn from that process to the umbilicus".

McBurney also dramatically changed the way in which appendicitis was treated. Although Reginald Fitz described appendicitis in 1886, it was still standard practice at the time to treat this condition medically with simple bed rest and supportive analgesia (e.g., opiates) since cases would sometimes resolve on their own. Surgery was reserved for appendiceal perforation or draining of any appendiceal abscess. Regardless, the approach was that of 'wait-and-watch' to see whether or not the patient improved. McBurney changed all this with his strong advocacy for early surgical intervention to prevent perforation or abscess formation. With early surgical intervention and with great surgical skill, Charles McBurney was able to dramatically reduce the morbidity and mortality of his patients suffering from appendicitis. The dramatic decrease in peri-operative morbidity and mortality attained by McBurney was due in part to the standardization of his surgical approach using the 'Gridiron' muscle-splitting incision (also known as McBurney's incision). Although this incision was developed by a Chicago surgeon, L.L. McArthur, it was McBurney who standardized its use and published the first paper in 1894 describing the advantages of this incision as being a more direct approach to the vermiform appendix while decreasing the incidence of post-operative incisional hernias.

Charles McBurney was truly a talented and gifted surgeon. Throughout his career he clearly demonstrated his ability to communicate his surgical knowledge through his numerous publications. In his clinical practice he had established a strong reputation for himself as perhaps the most sought after surgeon in the Manhattan area. Although McBurney had a very diverse clinical practice with numerous interests outside the realm of general surgery, he will likely be remembered best for his work in the treatment of appendicitis. His ability to completely revolutionize the way in which this condition is treated is simply one example of his many contributions to the field of surgery, and because of this, McBurney's name has found its place in history.

References

1. Cartwright, Frederick F. The Development of Modern Surgery. London: Arthur Barker Limited, 1967.
2. Earle A. Scott. Surgery in America. 2nd ed. Toronto: Praeger Special Studies, 1983.
3. Ellis, Harold. Surgical Case-Histories from the Past. London: Royal Society of Medicine Press Ltd., 1994.
4. Leonardo, Richard. History of Surgery. New York: Froben Press, 1943.
5. Meade, Richard H. An Introduction to the History of General Surgery. Toronto: WB Saunders Co., 1968.
6. Talbot, John H. A Biographical History of Medicine. New York: Grune and Stratton Inc., 1970.
7. Walker A. Earl A. History of Neurosurgery. New York: Hafner Publishing Co., 1967.
8. Wangensteen, Owen, Sarah. The Rise of Surgery. St. Paul: University of Minnesota—North Central Publishing Co., 1978.

Chapter 25

Carl Johann August Langenbuch (1846-1901)

Maurice Blitz

In the latter half of the 19th century, Europe was inundated with some of the great pioneers in the field of surgery. Names such as Billroth, and Courvoisier are still very much part of today's surgical lexicon. Germany specifically was a site for some of these revolutionary surgeons, contributing such notaries as Kocher and Langenbuch. Amidst these giants however, history has almost completely lost the surgeon responsible for one of the most common general surgical procedures.

Carl Johann August Langenbuch (who is often confused with the much more recognizable Langenbeck—the still renowned surgeon and teacher) was born in Kiel Germany in 1846. He attended medical school in Berlin and, at 23 years of age, was awarded his degree after a doctoral dissertation on rupture of the aorta. Langenbuch stayed in Kiel and commenced his surgical training under the tutelage of the noted military surgeon Friederich von Esmarch (originator of the Esmarch bandage or tourniquet). Langenbuch furthered his surgical training under Wilms who was then the chief surgeon at the Bethanien Hospital in Berlin. Upon finishing his training, Dr. Langenbuch stayed in Berlin and took a position at Lazarus Hospital of which he subsequently was named director. Langenbuch continued working there well into his 50's until he succumbed, on June 9, 1901, to peritonitis secondary to appendicitis.

Langenbuch had a variety of interests within surgery. His experiences during both the Franco-Prussian and Russo-Turkish wars fostered an interest in war wounds and their treatment—a subject about which he published several articles. At one stage he also investigated a surgical cure for Tabes through the stretching of nerves. His most significant achievement however, involved the gallbladder and its stones.

The 18th and 19th century were significant with regards to advances in the knowledge and treatment of acute cholecystitis and cholelithiasis. To better understand the climate, however, one should look back several hundred years.

Gallstones had been recognized for centuries, even having been found in ancient Egyptian mummies. Alexander of Trailes, a Greek physician in the 5th century, described gallstones but was unaware of any relation to disease. It was 1507 when Antonia Benivieni of Florence declared that the presence of gallstones was related to disease. Another 74 years passed until a clinical account of recognized gallbladder symptoms was published by Jean Fernel in 1581. He described an extensive constellation of symptoms which included acholic stool, dark-colored urine, and jaundice.

Many people suffered from and were afflicted by this new described disease. The treatments offered up to that time were futile, leading Etmuller in 1708 to conclude that "there are no medicines which will dissolve gallstones, for even when cholelithiasis appears healed, stones soon recur and lead to death."

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

This conclusion, along with some good fortune led to the emergence of J.L. Petit into prominence. In 1716 Petit had observed the draining of what was believed to be a right upper quadrant abscess. He noted, instead, that after the incision was made the site drained bilious fluid. Also, he described retrieving a gallstone of considerable size from the persisting fistula. In 1742 Petit published a discourse in Mémoires de l'Académie Royale de Chirurgie regarding the preceding case and other observations concerning the bilious drainage from distended, symptomatic gallbladders when punctured. He also noted that the success of any procedure involving the gallbladder was in large part dependent on whether bile escaped into the peritoneal cavity. In 1743 Petit proposed a revolutionary procedure. He suggested making a small abdominal incision in the right upper quadrant and, if the gallbladder was adherent to the undersurface of the abdominal wall, removing the gallstones and leaving a fistula (a cholecystostomy).

Twenty-four years later, a navel surgeon named Herlin was deeply cognizant of the futility associated with gallbladder wounds and started a series of experiments. He performed cholecystectomies on cats and dogs, noting that "one can remove the gallbladder without great danger, and this discovery opens the way to a safe approach to stones collected in the gallbladder or impacted in the biliary ducts where they often produce ratal complications". Unfortunately, his observation was largely ignored, and the medical community stayed the course outlined by Petit.

During the mid-1800s John Louis William Thudichum, a German-born clinician and chemical pathologist living in England studied cholelithiasis, and his research led him to conclude that direct stone extraction was the most promising approach to this problem. This statement came at a time when the medical community still viewed cholecystitis in the fatalistic manner described by Gibson in 1858.

Apparently unaware of Thudichum, John Stough Bobbs, an American surgeon from Indiana, was performing a procedure for cholelithiasis in 1867 He opened the gallbladder, removed the stones that were accessible to him, and once the gallbladder walls were reapproximated, he placed the gallbladder suture site near the undersurface of the abdominal wall incision. He termed this procedure "cholecys-totomy".

This procedure was slowly being adopted in America and Europe where, in 1878, Marion Sims, Theodor Kocher, and W.W. Keen all performed such a procedure. In 1879 Lawson Tait in Birmingham also began performing cholecystotomies. 25

Back in Berlin, Langenbuch was in a unique position as director of Lazarus Hospital. Cholecystitis and cholelithiasis had, until very recently, been primarily a medical concern. Langenbuch, as director, saw many of these cases and looked at them from a surgeon's perspective.

Langenbuch observed that neither elephants nor horses had a gallbladder and extrapolated that humans could survive without one as well. This was over 100 years after Herlin had come to the same conclusion following his experiments.

Langenbuch approached this novel concept through careful studies on autopsy specimens. He methodically removed the gallbladder in his subjects. A T-shaped incision was made by joining an initial longitudinal incision that traveled along the lateral margin of the right rectus abdominus muscle with a second incision that traveled transversely along the "inferior margin of the liver". Once the peritoneal cavity was breached, Langenbuch identified and "ligated the cystic duct 1-2 cm from the gallbladder". He thus proceeded to free the gallbladder from the liver bed. Next he cannulated and emptied the gallbladder of its bilious contents due to his overwhelming concern over intra-peritoneal spillage. Once completed, the cystic duct was resected and the gallbladder was removed.

Because his interest in cholelithiasis and cholecystitis was known, Langenbuch was asked to consult on a 43 year old gentleman who had been suffering from "severe gallstone symptoms" for 16 years. This man initially experienced bouts of severe colicky pain and persistent vomiting lasting about 1 day. Several years later the patient noted some of these episodes were being followed by a severe jaundice that would take several months to remit. He even noted passing several pea-sized gallstones with his stool at one instance. Over the last several years these symptoms were increasing in both severity and frequency, culminating in a greater than 35 kg weight loss.

The patient had been under maximal medical management the previous 3 years, including several trips to the spas in Carlsbad. Nonetheless his discomfort worsened, and several resulting pain induced syncopal episodes were described. The patient was requiring ever increasing amounts of morphine to palliate his discomfort.

Langenbuch noted a "tout swelling of the gallbladder" during one of his physical exams. He later described the patient as obviously cachectic, diaphoretic, and having "flaccid yellow skin as well as yellowed conjunctiva". In 1882 Langenbuch examined the patient and noted no tenderness in the right upper quadrant as well as noting no palpable gallbladder. Dr. Langenbuch felt the patients' future was bleak and that the he was currently "traveling on a path from which return seemed impossible."

On July 10, 1882, Langenbuch admitted his patient to hospital for a planned cholecystectomy. The patient was placed on bed rest and was "purged in preparation" of this momentous event. Five days later, in the presence of Drs. A. Martin and F. Busch and other well-wishers, Carl Johann August Langenbuch methodically repeated the well-rehearsed steps and performed the first cholecystectomy. The gallbladder appeared thickened, but there were no signs of acute inflammation in this surgical specimen. Two "millet seed" size stones were found. (Langenbuch assumed that the stone content would have been higher if it were not for the thorough preoperative purging).

The next day Dr. Langenbuch was greeted on his morning rounds by a patient sitting in bed smoking a cigar. The patient was hungry and had normal vital signs. By day 12 the patient was out of bed and he was subsequently discharged from hospital 8 weeks after surgery. The patient had recovered 13.5 kg during this period, and had used no morphine since shortly after the operation.

This remarkable result led Langenbuch to expound "cholecystectomy is preferable to assigning the patient morphine and the incalculable turns of this insidious disease".

When Langenbuch published this account, there was considerable controversy over what was the most appropriate procedure. Lawson Tait strongly advocated cholecystotomies, while Langenbuch countered "the extirpation of the gallbladder performed by me for insidious cholelithiasis, after preceding ligation of the cystic duct, may be regarded as the less dangerous and more effective method, as well as for other disease processes of the organ". Langenbuch had recognized the complications of cholecystotomies including secondary bile leaks and the formation of persistent fistulas.

At the time of his death in 1901, Langenbuch had performed only 5 cholecystectomies. He had, however, radically changed the face of surgery. By 1921, cholecystectomy had become the procedure of choice for symptomatic cholelithiasis and continues to this day (though often done laparoscopically) to be one of the most often performed general surgical procedures. Unfortunately, Langenbuch's name to this contribution has all but been erased. He has been overshadowed by the giants of his time, and his place in the annals of surgery has been delegated to an anonymous corner.

References

1. Baily H, Bishop WJ. Notable names in medicine and surgery. London: HK Lewis & Company Ltd., 1959.
2. Cartwright F. The Development of Modern Surgery. London: Arthur Barker Limited, 1967.
3. Cope Z. A History of the Acute Abdomen. London: Oxford University Press, 1965.
4. Ellis H. Surgical Case—Histories from the Past. London: Royal Society of Medicine Press, 1994.
5. Heimburger IL, King RD. Durgery and gallstones—From helplessness to triumph. Surgery 1965; 57:325-330.
6. Langenbuch CJA. Ein fall von exstirpation der gallenblase we-gen chronischer cholelithiasis. Heilung. (A case of extirpation of the gallbladder for chronic cholecystitis. Cure). Berlin Klinische Wochenschrif 1882; 19:725-7.
7. Langenbuch CJA. Ein Rukblick auf die Entwicklung der Chirurgie des Gallensystems. Verhandlungen derDeutschen Gesselchaft fur Chirurgie 1896; 68.
8. Leonardo RA. History of Surgery. New York: Froben Press, 1943.
9. Meade RH. An Introduction to General Surgery. Philadelphia: WB Saunders Company, 1968.
10. Traverse LW. Carl Langenbuch and the First Cholecystectomy. Am J Surg 1976; 132(1):81-2.

Chapter 26

William Stewart Halsted (1852-1922)

Luis H. Toledo-Pereyra

If Phillip Physick (1768-1809), the noted Philadelphia surgeon, is considered by some the Father of American Surgery, one could rightly name William Stewart Halsted (1852-1922) the Father of Modern American Surgery. Halsted contributed in many ways to the modern development of this discipline through his long-term commitment to the practice of the art and science of surgery. He expanded the horizon of the future specialist, defined the field in more specific terms, and fully organized the training of surgeons.

Halsted came from New York, where his family had a prominent social position in the city and on the New York Hospital Board. Andover, Yale, and Columbia were the origins of his high school, college, and medical studies. His internship, oriented mostly toward surgery, took place at Bellevue Hospital, which prepared him well to be staff physician of the New York Hospital in 1878.[1]

In the fall of the same year, he left for Europe with the hope of becoming acquainted with the best surgical schools of the time. In this expedition, he encountered the great surgical masters of their generation. Halsted learned from them the most advanced surgical methods and began to mold his mind in regards to the future of surgical training. Among those whom young Halsted visited and admired were Chiari, Zukerkandl, Billroth, Woelfler, and Mickulicz in Vienna; von Kolliker, Stohr, and von Bergmann in Wurzburg; and Weigert, Thiesch, and von Volkmann in other German cities. His European sojurn was permeated by the most important German theories and methods and the most influential surgeons of the world.[2] In 1880, he returned to the United States and brought with him renewed interest in practicing safe surgery with the best antiseptic methods. While back in New York, he became associated with Roosevelt and Presbyterian Hospitals, among several others. His intentions then did not appear to have an academic tone. He was simply practicing the surgery of the day.

Around 1884, Halsted became addicted to cocaine as he experimented with its use as a regional anesthetic. A series of troublesome years resulted. Inasmuch as this finding appeared important, the pathologist William Welch (1850-1934), former New York friend and director of the academic development of the future Johns Hopkins, invited Halsted to join him in his research laboratories. Here, Halsted began his surgical research career in the midst of various long visits to Butler Hospital in Rhode Island to keep his addictive problems under control.[3]

Welch was persistent in his desire to rehabilitate his friend and enlisted the new chief of medicine at Johns Hopkins, William Osier (1850-1923), in a close evaluation of Halsted's condition with the possible consideration for a job if he had demonstrated signs of controlling his addiction. The day came with a positive development

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

for the history of surgery when in 1892, he was named professor and chief of surgery of the newly created Johns Hopkins Hospital and Medical School. The rest is history. This particular appointment was going to be the most significant and relevant event in modern surgical times.

Halsted was the first modern American surgeon to begin the systematic training of surgeons, as well as the first to introduce a systematic approach to the understanding of surgical disease where physiology and pathophysiology occupied a place of honor in patient management. He practiced safe surgery at all times and believed that planning and execution were the two most important phases of surgery. He continuously preached that tissues should be treated gently, that hemostasis was critical, and that infection should be prevented at any cost. His triple approach of gentleness—asepsis—hemostasis was fundamental to his advanced surgical method. To Halsted, surgery meant physiological surgery, surgery of detail, and above all safe surgery. In this regard, he should be considered the Father of Safe Surgery.

Halsted considered the operating theater as a laboratory of the highest order, and he utilized the surgical experimental area as a perfect path to recognize and advance knowledge of the appropriate management of surgical patients. Taking into consideration the condition of surgery at the time in the United States, Halsted was extremely advanced in the understanding of the principal factors mediating the morbidity and mortality of surgical operative procedures. His results clearly supported his well-defined approach to surgical disease.[4]

As briefly indicated before, Halsted developed what would be considered the most advanced training program for the modern surgeon at the time. Years of assistantship and chief residency would produce the Halsted surgeons. They would learn how to operate in regard to tissue management, attention to detail, adequate control of bleeding, and the use of techniques recently learned in the experimental surgery laboratories. After an average of more than 4 years of training, the upcoming surgeon would be well positioned to explore the underdeveloped opportunity existent in the country that would require competent professionals, knowledgeable in the art and science of surgery.

In 1922, after many years of professional contributions, William Stewart Halsted succumbed at the age of 70 to the injurious effect of cholelithiasis—ironically, a disease he had frequently studied throughout his life. Before he passed, he enormously enriched the field of surgery and left an extraordinary legacy for all to follow. His contributions to the general principles of surgery as well as to the treatment of specific diseases and the training of surgeons make him worthy of inclusion in the pantheon of the immortals of this discipline. Harvey Cushing would clearly agree in this respect[5] and give him the well-deserved title of Father of Modern American Surgery.

References

1. Toledo-Pereyra LH. William S. Halsted. Cirujano, Maestro e Innovador. In: Toledo-Pereyra LH, ed. Maestros de la Cirugia Moderns. Mexico City: Ed. Fondo de Cultura Economica, 1996:87-110.
2. Olch PD, William S. Halsted and local anesthesia: Contributions and complications. Anesthesiology 1975; 42:479.
3. Rutkow IM. William Stewart Halsted and the Germanic influence on education and training programs. Surg Gynecol Obstet 1978; 147:602.
4. Holman E. The legacy of William Stewart Halsted. Bull Am Coll Surg 1969; 54:99.
5. Cushing H. William Stewart Halsted 1852-1922. Science 1922; 41:461.

Chapter 27

Harvey Cushing (1869-1939)

Luis H. Toledo-Pereyra

Harvey Cushing (1869-1939) lived when scientific surgery began its extraordinary development. He attended the best eastern American schools (Yale, Harvard, Hopkins) and committed his life to the study and improvement of the neurological surgical sciences. His extraordinary accomplishments leave no doubt Cushing should be considered the father of American neurosurgery.[1]

Harvey came from Cleveland, where his family had settled after leaving England in the 18th century. His ancestors included a large number of physicians and thus it was not hard for him to focus on medical matters. He was the youngest of 10 brothers, and his father, Henry Kirke Cushing (1827-1910), a general practitioner, favored the boy and followed his progress closely. The senior Cushing advised as much as conceivable and supported young Harvey in all his decisions, including matriculation at Yale. There he paid particular attention to the classics, even though Latin was not a preferred subject, and in the basic sciences he advanced himself greatly. With the advice of Russell Chittenden, professor of physiological chemistry, and of his father, Harvey opted for Harvard Medical School in Boston, where he found the appropriate environment for his medical education.[1]

A curious and important event in his career occurred in 1893. While a medical student at the Massachusetts General Hospital (MGH), he was administering anesthesia to a patient with a strangulated hernia who passed away. This event convinced him and a student colleague, Amory Godman, to develop a series of charts for documenting vital signs during the operative procedure; this significant innovation is routine practice today. Harvey graduated cum laude from Harvard and remained at the MGH. In 1895, he claimed in a letter to his father that this hospital was doing things that no other American hospital was doing. While at MGH, the recently graduated Dr. Harvey Cushing participated in the introduction of X-rays to the medical armamentarium. After a few months, in 1896, he applied to Johns Hopkins in Baltimore and Halsted, the great surgical teacher, accepted him. This event was a precursor of greater accomplishments.

Harvey Cushing remained in Baltimore for 16 years under the advice and tutelage of William Halsted (1852-1922), creator of the American surgical residency (very similar to our current system) and of safe surgery. Cushing always thought very highly of his teacher and appreciated the great contributions he had made in the field of general surgery. At Halsted's passing, Cushing commented that one of the immortals of the discipline had died, but his teachings and disciples would continue his dedicated and sound labor.[2]

In 1900, Cushing's intense dedication to neurosurgery took him to Europe. He visited the most prestigious centers and individuals who had a distinctive interest in

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

the newly formed specialty, among them Kocher, Kronecker, and Sherington, the luminaries of their day. Only Horsley was missing, since he could not receive the young American surgeon at the time.[1] A year later, on his return to Hopkins, Cushing requested and received the position of neurosurgeon in the clinic. Since there were no specific departments for his line of interest, neurosurgery, he continued in the general surgery staff of Dr. Halsted with the particular assignment of neurosurgical cases.[1]

Cushing's contributions to neurosurgery continued while in Baltimore; he introduced the Riva-Rocci apparatus to measure blood pressure during surgery, organized the Hunterian experimental surgery laboratory, developed several tourniquets to control intracranial hemorrhage, introduced silver metallic clips for ligating bleeding blood vessels, invented a new method of suturing the dura to prevent leakage of cerebrospinal fluid, developed the transphenoidal approach for pituitary surgery, and adopted the use of balanced physiological solutions for nerve—muscle preparation, as well as the use of black ligatures for large cotton gauzes.[1,3,4]

In 1912, he moved to Harvard's Peter Bent Brigham Hospital, where he accepted the position of professor and surgeon-in-chief of the institution. His contributions included improving the surgical research laboratories, developing new methods of operating on the acoustic nerve, classifying more effectively the intracerebral gliomas, introducing an electrocautery unit for hemostasis, characterizing an unknown disease of the pituitary gland, and assembling an extraordinary collection of 2000 pathological specimens of brain tumors for the training of future neurosurgeons.

Cushing was an accomplished academician. In addition to his surgical work, he was a teacher for younger generations, an excellent writer of papers, books, and biographies, and a gifted artist. He trained more than 40 surgeons who spent variables amount of time in his service. His life as a writer culminated with "The Life of William Osler," for which he won the Pulitzer Prize, becoming the only surgeon or physician to win this coveted award.[5]

Harvey Cushing reached the zenith as a neurosurgeon, author, and teacher, leaving a medical legacy of professional excellence for us to admire and follow. He represents the ideal academic surgeon, one who advanced the art and science of neurosurgery to unprecedented heights.

References

1. Toledo-Pereyra LH. Harvey Williams Cushing. Padre de la neurocirugia Norteamericana moderna. In: Maestros de la Cirugia Contemporanea. Mexico City: JGH editores 1999:1-26.
2. Cushing H. William Stewart Halsted. Science 1922; 56:461.
3. Toledo-Pereyra LH. Harvey Williams Cushing. Cirugia Gen 1998; 20:158.
4. Cushing H. The control of bleeding in operations for brain tumors. Ann Surg 1911; 54:1.
5. Fulton JF. Harvey Cushing. A biography. Springfield: Charles C. Thomas, 1946.

Chapter 28

Marie Joseph Auguste Carrel (1873-1941)

Luis H. Toledo-Pereyra

In 1912, the Nobel Committee awarded the coveted Nobel Prize of Physiology and Medicine to a visionary scientific surgeon commonly known as Alexis Carrel (1873-1941). After knowing the consequences of the penetrating injury of the portal vein with massive bleeding suffered by France's President Sadi Carnot, Carrel—aided by his mother—learned to sew blood vessels with a great degree of precision. His success rapidly reached extraordinary heights and surgeons and scientists readily recognized his unique contribution.[1]

Professor Akerman, of the Nobel Committee, who introduced Carrel, ascertained that he "was the first person, as a result of work begun some ten or twelve years ago in Lyon, to invent a better and more reliable method of sewing vessels together again.[2]" Carrel had pursued his initial studies with extraordinary persistence while relocating first to the University of Chicago and later to the Rockefeller Institute in New York, where he amply demonstrated and confirmed his early promise.

The essence of Carrel's vascular suturing discoveries can be summarized as: (1) proper approximation of blood vessels; (2) use of triangular, equidistant retaining sutures; (3) protection of endothelium; (4) protection of blood vessels by avoiding use of forceps; (5) maintenance of wide-open lumen approximation and opposition of endothelium; (6) use of fine, sharp, round and straight needles (Kirby type); (7) threads sterilized and saturated in petroleum jelly to diminish possible thrombus formation; (8) blood vessels humidified with Ringer's solution; and (9) suturing while the wall is under tension by traction or retaining stitches.[3] The instrumentation was simple and included temporary hemostasis clamps with spring, Crile clamps for large vessels, smooth-jawed forceps, round straight Kirby (No. 16 and 12) and curved needles, although he preferred straight needles.[3]

By the time that Carrel arrived in America in 1904, his discoveries on the suturing of blood vessels had gained the recognition and admiration of American surgical notables. A year later, Harvey Gushing, Rudolph Matas, George Crile, and J.M.T. Finney visited him in his Chicago laboratories. Carrel used the dog in a demonstration of vascular anastomosis on the carotid artery. Gushing observed that Carrel's work was the only innovative experimental study performed for a long time.[4]

Carrel's stay at Chicago was short lived. He remained at the University Hull Physiological Laboratory less than two years. Inadequate animal facilities and an atmosphere that did not fully satisfy him were the main reasons for his departure. In addition, C. C. Guthrie, a physician in the physiology laboratory and his close collaborator, had decided to move to the University of Missouri.

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

In September 1906, Carrel found himself at the recently founded Rockefeller Institute in New York. Harvey Cushing had relayed Carrel's professional accomplishments to Simon Flexner, the renowned pathologist director of the institute, who promptly offered him a position. Carrel readily accepted and soon had his laboratory well organized and fully operational. Many surgeons and well-known personalities flocked to his laboratories. After completing his studies on the suturing of blood vessels, his attention was mainly focused on organ transplantation, mostly of limbs and kidneys for technical reasons.

Carrel was an exceptionally talented surgical technician. He had keen observational abilities and his knowledge of current scientific developments was extraordinary. He closely followed the medical literature, particularly in surgery and tissue and organ repair. His commitment to surgical research was unquestionable and represented a lifelong determination to succeed.

Carrel delved into tissue culture and organ preservation with characteristic dedication. He clearly understood the principles behind this new science and maximized its understanding and the development of the scientific process.

Charles Lindbergh, the famed aviator, was one of Carrel's closest friends. From 1930 to 1942 they maintained a close relationship, incremented by the common understanding and similar philosophical approaches of the two men. Lindbergh truly admired Carrel and compared him to Einstein. Lindbergh said, "He was one of the most extraordinary men I have ever known, and I say this being aware of his eccentricities. and I never found anyone more stimulating to my mind."[4] Carrel had the same appreciation for Charles Lindbergh.

Lindbergh, under the scientific tutelage of Carrel, improved the method of washing red blood cells by modifying the standard centrifuge so that it would rotate at 4,000 rpm. He developed, with Carrel, new tissue-culture chambers, and he thoroughly investigated the possibility of developing a perfusion apparatus for larger organs. He did not fully succeed on this account.

Details of the professional and personal career of Carrel while at the Rockefeller Institute, the writing and publication of his philosophical book, Man, the Unknown (1935), the ill-founded allegations of collaborating with the Nazi government, as well as other important aspects of his life and accomplishments will not be addressed here.

All in all, Carrel was a visionary surgical scientist. He was a pragmatic man who thoroughly understood the scientific principle and knew how to apply it to its fullest. Carrel leaves a legacy of writing and a body of work for future surgeons and scientists to learn the how and why of their professions.

References

1. Anaya-Prado R, Toledo-Pereyra LH. In: Calderon M, ed. Alexis Carrel: Historia de un Cirujano, in Filosofia Quirurgica. Mexico: McGraw-Hill Interamericana, 2001:1-13.
2. Ackerman J. Physiology or Medicine 1912, in Nobel Lectures Physiology or Medicine 1901-1921. Nobel Foundation. Amsterdam: Elsevier Publishing Company, 1967; 437-441.
3. Carrel A. Suture of blood-vessels and transplantation of organs. Nobel Lecture, December 11, 1912, in Nobel Lectures Physiology or Medicine 1901-1921. Nobel Foundation. Amsterdam: Elsevier Publishing Company, 1967; 442-464.
4. Malinin Tl. Surgery and Life. The Extraordinary Career of Alexis Carrel. New York: Harcourt Brace Jovanovich, 1979.

Chapter 29

Ferdinand Sauerbruch (1875-1951)

Sonja Kötting and Susanne Greschus

Ferdinand Sauerbruch was a great pioneer of surgery who first worked in Zurich and Munich and then from 1928 on at the Charite in Berlin. He became well known because of his inventions which lead to great progress for medicine. Examples of his epoch-making inventions are the low-pressure chamber, Sauerbruch-Arm, a new diet for patients with tuberculosis, and several operative techniques.

He initially experienced difficulties with his medical superintendent, Professor von Mikulicz, who called him a charlatan but later fully supported Sauerbruch's work. A lot of famous personalities have been under his medical treatment. Sauerbruch's autobiography in 1953, A Surgeon's Life, reveals a dynamic man with deep concerns for his patients and colleagues.

Ferdinand Sauerbruch was born on July 3, 1875 in Rem near Barmen-Elberfeld. After the death of his father when he was two years old, he spent his childhood in poverty. With his mother, he went to live with his grandfather, a retired shoemaker, who cared for them. In 1885, Sauerbruch went to the "Realgymnasium" in Elberfeld. Shortly before he did his A-levels, his grandfather died and the family fell into poverty again. The former talented and hardworking student started to miss school and almost failed his final exams. In 1895, Sauerbruch moved to Marburg to start his studies in the sciences. He was first interested in physics, chemistry, and botany until he went into medicine. Sauerbruch spent the clinical part of his medical studies in Marburg, Jena, and Eeipzig. In Leipzig, he did his final medical exam in 1901, the approbation and the doctoral thesis. To earn some money, he set up a small practice in Erfurt. Although he experienced a lot of success, this work was not satisfying for him. He went to Dr. Bock in Erfurt where he started to operate and wrote his first papers. In 1903, he went to the Pathologic-Anatomic-Institute of Paul Langerhans in Berlin-Moabit. Shortly after this, Johannes v. Mikulicz became interested in his work and offered him a job as his assistant at the University of Surgery in Breslau. Under v. Mikulicz's supervision, Sauerbruch started to work on experiments on the low-pressure chamber. After a fiasco during a demonstration, he had a disagreement with v. Mikulicz who dismissed him from the clinic. Because of the engagement of Willy Anschutz, v. Mikulicz's son-in-law, Sauerbruch returned and became v. Mikulicz's favorite student. Together, they developed many new operative techniques and experienced a great deal of success. In 1905, Sauerbruch got his Habilitation for his work "Experimentelles zur Chirurgie des Brustkorbes und Oesophagus" (Experimental surgery of thorax and esophagus). When he was 35 years old, he became Head of the University of Zurich Surgical Department (1910-1918). At 43 years of age, he had the same position in Munich and finally in 1927 he went to the Charite in Berlin.

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Besides his work as a reputable and gifted doctor, Sauerbruch inspired many publications for the following generations of doctors. His investigations were mainly on the field of thoracic and lung surgery. Of the most historical importance was the study which began in 1904 and dealt with a simplified artificial ventilation, the pathology of the open thorax, pneumothorax, and the principles of pressure differences as a basis for operations on the thorax. His investigations in operations on the opened thorax created a turning point in lung surgery. He was not only engaged in the fight against tuberculosis but also could help patients with operations like decor-tation or lobectomy. His new operative techniques meant hope for survival or improved quality of life for patients who would not have had any chance to get help before.

Sauerbruch's investigations in thoracic surgery are a very important and well-known part of his work, but he also developed several surgical techniques in other fields. A famous example is the "Sauerbruch-Arm" which is a prosthesis after amputation in which muscles of the humerus are used to move an artificial hand. He realized an idea of G. Vanghetti in resection of the femur. In operations where greater parts of the upper leg had to be removed, Sauerbruch used parts of the lower leg to replace the upper leg. He was also a pioneer in abdominal surgery, where he was the first to do an anastomosis between the stomach and an esophagic stump after resection of the esophagus. He therefore changed the position of the stomach from the intraabdominal cavity to the thorax.

Ferdinand Sauerbruch became an outstanding person of his time and the most popular surgeon of his generation. Although he was known for his remarkable surgical work, his popularity lay in his thrilling temper, his vivacity, his outstanding genius, his oratorical gift, and his unbroken courage in personally and politically difficult times.

During the Second World War, he had contact with persons of the resistance against the Third Riche, such as Graf von Stauffenberg. This put him in great danger and he was probably not arrested because of his important position in the Charite. Under very difficult circumstances, he also continued to operate in air-raid shelters when the Charite was nearly totally destroyed by bombardments.

After the Second World War, Sauerbruch's fate was tragic. He had never been able to deal well with his money and, although he had a magnificent income, he put a great financial burden on himself and his family by founding a private clinic in Zurich. Later he suffered from cerebral sclerosis which changed his personality. Unfortunately, the destruction of Sauerbruch's formerly respected genius was seen by the public, as he was kept in his position for political reasons.

References

1. Carstensen G. Sauerbruch in Mulheim. Zentralbl Chir 1980; 105(4):249.
2. Davies MK, Hollman A. Ferdinand Sauerbruch (1875-1951). Heart 1997; 77(4):301.
3. Dittrich NM. The work of Ferdinand Sauerbruch (1875-1951). In GreifswaldZenrra/ b/Oi/r 1986; 11(22):1415-1418.
4. Kyle RA, Shampo MA. Ferdinand Sauerbruch. JAMA 1980; 243(29):2052.
5. Meyer JA. Unterdruck and Uberdruck, 1904. Ann Thor Surg 1989; 47(6):933-938.
6. Moerchel J. Sauerbruch and the Majos. Dtsch Med Wochenschr 1980; 105(19):697-699.
7. Morgeli C. A surgeon politicizes: The Sauerbruch scandal of 1915. Schweiz Rundschr Med Praxis 1988; 77(6):123-127.

8. Morgeli C. Professor Sauerbruch and the honorarium. Schweiz Rundschr Med Prax 1993; 82(15):451-456.
9. Sachs M, Bedecke KH. From the history of surgical instruments: 6. Sauerbruch's instruments. Zentralbl Chir 1997; 122(8):710-717.
10. Taubert E. Surgical heritage. The first 50 years of modern surgery. Zentralbl Chir 1990; 115(8):483-488.
11. Toellner R. ll/ustrierte Geschichte der Medizin, Band 6. Salzburg: Andreas & Andreas, 1986:3333-3334.
12. Wolff H, Pertschy J. Our surgical heritage: Sauerbruch and the thoracic surgery. Zentralbl Chir 1989; 114(19):1299-1308.
13. Zenker R. Sauerbruch and the development of thoracic surgery. Munch Med Wochenschr 1975; 117(45):1815-1818.

Chapter 30

Wilder Penfield (1891-1976)

James Brooks, Jonathan Chaney, Dong Wu and Barend Zack

Wilder Penfield ranks among the most accomplished and internationally recognized Canadian physicians, for his achievements in wide-ranging areas of neuroscience and neurosurgery. His career was as dazzling as the list of names of the medical giants who were his teachers and mentors. Penfield's contributions include a wealth of writings in both medical and diverse nonmedical subjects; undoubtedly, however, his crowning achievement was the creation of the world-famous Montreal Neurological Institute in 1934, known for diagnosis and treatment of difficult neurological disease.[1]

Penfield was born in the Pacific Northwestern United States, in Spokane, Washington, on January 26, 1891. He found himself in a family rich with medical tradition; his father, Dr. Charles Samuel Penfield— himself the son of a physician—become Spokane's first physician after settling there to search for a "fresh air cure" for a puzzling disease.[2] The family's financial failure led Penfield's mother to move him at age eight with his brother and sister to her parents' home in Hudson, Wisconsin. It was his mother who, teaching him at a preparatory school she helped to develop, turned out to be the most important formative influence in his early life.[2]

As Penfield grew up, he displayed in both scholastic and athletic endeavors what he would later call "the only certain virtue—tenacity of purpose." He wanted to be an "all-rounder," and he displayed leadership in all of his pursuits.[3] He received an honors degree in philosophy in 1913 at Princeton, where he played football and became one of its best players and later its coach. Penfield's prowess in athletics, his initiative in tackling politics, and his leadership qualities were factors that allowed him to receive a Rhodes scholarship in 1914.[2] Before taking advantage of this scholarship, which afforded him the means to study at Oxford for 3 years, he studied at Columbia University in New York to decide what he wanted to do with his life. It was there that he decided to pursue his interest in helping people, and to study medicine in England.

Thus began a remarkable medical career—one made all the more fascinating because of the people whom Penfield encountered and by whom he was influenced. At Oxford, he had the good fortune to work with Sir William Osler, from whom he learned that compassion was the first essential characteristic of all good doctors. However, it was his interaction with a man who was "probably the preeminent neurophysiologist of his day"[1] that determined the direction of his career in medicine. While Osler demonstrated for him attributes of a great physician, it was Sir Charles Sherrington who "opened up for Penfield the gates into the unexplored regions of brain physiology and research."[2] Penfield spent much time in Sherrington's lab watching and learning, then eventually performing his own experiments under Sherrington's

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

supervision. It was then that he decided to become a surgeon that specialized in the brain and nervous system, or, as he put it, a "neurologist-in-action."

Penfield spent his first 2 years of medical training in England at Oxford, then continued at Johns Hopkins University for his third year. He returned to Europe during World War I; he worked in a Red Cross Hospital in Ris Orangis, France, and studied war injuries. When the Surgeon-in-Chief of the American Expeditionary Force insisted he return to the United States to complete his training, Penfield did so and graduated from Johns Hopkins with an MD in 1918.

Penfield's clinical training and career took him back and forth from the United States to Europe, and finally to Montreal, Canada. Also, it brought him across the paths of incredible physicians. As an intern at Peter Bent Brigham Hospital in Boston he worked with Dr. Harvey Cushing; he was invited by Allen Whipple to New York's Presbyterian Hospital; and he studied in Spain with Pio Rio-Hortega, pupil of Nobel prize winner Santiago Ramon y Cajal. In addition to being influenced by William Osier, he studied under Charles Sherrington for neurophysiology, and Gordon Holmes for neurology.

In 1928 Dr. Edward Archibald, Canada's leading brain surgeon, felt there was a need in Montreal for a place devoted entirely to study and work on the nervous system. He recruited Penfield to leave New York, move to Montreal to practice neurosurgery, and work toward the foundation of a neurological institute. In October of the same year, Penfield proposed the idea of a neurological institute for the study and cure of brain diseases to the Board of the Rockefeller Foundation. With half of the money from Rockefeller and the rest from the province of Quebec, the city of Montreal, and private citizens, a stone building, property of McGill University, was completed in the fall of 1934. The opening of the Montreal Neurological Institute (MNI) included Gushing delivering an address and Penfield acting as director.[2]

From the beginning of his career as a neurosurgeon, Dr. Penfield was concerned about the cause and cure of epilepsy. Not surprisingly, this was a major focus during his time as director of the institute, and his work led to improved neurosurgical techniques, especially for severe epilepsy. He and his team of doctors were said to have performed more operations for epilepsy than any other doctor in the world, and about half of all his cases were completely cured. His work at the MNI also improved neurology knowledge; in the 1950s he mapped out the brain's motor cortex, as part of the "Montreal procedure" where, using local anesthetic, he could probe exposed brain tissue and monitor a patient's sensations and movements. He also made advances in understanding the nature of memory.

As Penfield grew more experienced, he began to publish research and texts. Having become an international authority in neurology, neurosurgery, and neuropathology, he wrote Cytology and Cellular Pathology (1932), Epilepsy and Cerebral Localization (1941) with Dr. Theodore Erickson, A Manual of Military Neurosurgery (1941), Epilepsy and the Functional Anatomy of the Human Brain (1954) with Dr. Herbert Jasper (a textbook on epilepsy based on 750 of their cases), The Cerebral Cortex of Man (1950), Epileptic Seizure Patterns (1950), and Speech and Brain Mechanisms (1959) with Lamar Roberts.

Later in his career, and as his medical career reached its pinnacle, Penfield began to diversify his writings, turning to historical, cultural, sociologic, and fictional topics. Products of this "second career" as an author started with the rewriting of his mother's novel, No Other Gods (1954), which was based on the biblical story of Abraham. Other titles included The Torch (1960), a biographical novel of Hippocrates; The Second Career (1963), a collection of essays about his interests later in life; The Difficult Art of Giving (1967), a biography of Alan Gregg; Man and His Family, reflecting Penfield's feeling that the home was where education first began; and The Mystery of the Mind (1974), dedicated to Sir Charles Sherrington and a recounting of his search for answers as to the nature of the human mind for the past 40 years. Three weeks before Penfield's death at age 85 in 1976, he completed his autobiography No Man Alone. In this book he proposed that the study of the brain both clinically and in research must be a team approach. He dedicated No Man Alone to the memory of his mother, for allowing him "to see things as they were".

Wilder Penfield resigned his professorship of neurology and neurosurgery at McGill University in the spring of 1954, but remained director of the institute until I960. His successor William Feindel said "his distinguished contributions were recognized as unique by his neurosurgical and scientific colleagues." Edgar Douglas Adrian, a British neurologist and Nobel Laureate, called Penfield "a skilled neurosurgeon, a distinguished scientist, and a clear and engaging writer" but one whose first concern was always for the patient.

It is said that Wilder Penfield has received more degrees than any other member of the medical profession. His incredible slate of positions, degrees, and honors included President of Royal College of Physicians and Surgeons of both Canada and of the American Neurological Association; Fellow of the Royal Society of London; honorary degrees from Princeton, McGill, Montreal, and Oxford; the U.S. Medal of Freedom; and Crosses of the French Legion of Honor and the Greek Legion of George I. In June 1953, Dr. Penfield was awarded the Order of Merit—the highest honor bestowed by the monarch in the British Commonwealth.

According to The Centennial Anniversary Volume of the American Neurological Association 1875-1975: Wilder G. Penfield ranks among the most accomplished and internationally recognized Canadian physicians, for his achievements in wide-ranging areas of neuroscience and neurosurgery. His contributions include a wealth of writings in both medical and diverse nonmedical subjects; undoubtedly, however, his crowning achievement was the creation of the world-famous Montreal Neurological Institute in 1934, known for diagnosis and treatment of difficult neurological disease.

References

1. Horowitz NH. Library: Historical perspective. Neurosurgery 1997; 41(1):314-318.
2. Pratt VW. Canadian portraits: Famous doctors—Osler, Banting, Penfield. Clarke, Irwin, 1956.
3. www.mondrian.priceton.edu/CampusWWW/Companion/ penfield-wilder.
4. www.heritageproject.ca/media/minutes/expanded/penfield.

Chapter 31

Charles Brenton Huggins (1901-1997)

Luis H. Toledo-Pereyra

Surgical investigation, like investigations in many other disciplines, begins with an idea which is fortified and fully nurtured with knowledge and determination. The advancement of the initial idea, as simple as it may be, requires diligence and a well-structured plan. Now, how and when this plan is executed pertains to the territory of the commitment and dedication of the surgical investigator.

Discovery in surgical investigation is vital to the enterprise, that is, to the progress and development of the surgical sciences. Charles Brenton Huggins (1901-1997) was a classical surgical investigator who clearly focused on advancing pure surgical knowledge. With work developed in his laboratories at the University of Chicago, on the hormonal treatment of prostatic cancer, he secured the Nobel Prize for Physiology and Medicine in 1966. Professor Huggins had a noble and incredible motto: Discovery is our business. This sentence reflected his deeply ingrained appreciation of discovery in the surgical arena.[1] His students had to endure frequent questioning in regards to their discoveries each day. What did you discover today? the professor would ask his students. It was wise for him to ask since we need, seek and require a discovery every single day. Our attitude towards discovery is then vital to the enterprise.

How can we teach discovery to our students? It is not that simple to impart this particular quality since discovery is a combination of attitudes and influence. Yet discovery is at the core of the sciences. We learn, we discover, we do science and in the end we publish. Discovery goes hand in hand with knowledge, discovery reaches for answers, discovery is by itself what the investigator dreams of. Teaching discovery includes a discovering personality supported by infrastructure to transform ideas into real products. The senior investigator educates the younger pupil about scientific advances, already aiming at their translation into practical application. Discovery requires that all steps of science be rehashed with dedicated enthusiasm. The surgical discoverer is on the verge of the future. Think of it this way:

Discovery = knowledge + innovation + findings

In the early 20th century, a new breed of American surgeon-investigators/surgeon-scientists, dedicated themselves zealously to answering perennial surgical questions. They planted the seed and aspired to find fundamental critical answers. They fit the bill as discoverers, innovators, creators. In this group were William Halsted (1852-1922), William Mayo (1861-1933), George Crile (1864-1943), Evarts Graham (1883-1957), Owen Wangensteen (1898-1981), Walt Lillehei (1918-1999) and so many others. America provided, during this time, a great number of accomplished

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

surgeon-scientists/investigators. Their common denominator was desire, intrepid-ness, unquestionable work-ethics and willingness to challenge the unchallengable and to reach for uncharted territories. Unlimited commitment and perseverance characterized their intense desire. They embarked on a mission of discovery dedicated to finding the best cures possible. They conquered and put forward a new therapeutic approach. They revolutionized surgical practice.

Charles Huggins understood the young mind of his time and cultivated their relationship under all circumstances. He believed a mentor's obligation was to feed the immature mind of beginners, to offer truths to their important questions and to maintain their enthusiasum.[1] He quoted Emerson, "It came to him business, it went from him poetry". His position on scientific endeavors was clear, he understood that one should improve experimentation with thoughtful experience, and that deeper knowledge was obtained from continuous research.[1] He also understood that recognition of a problem was crucial in obtaining the definitive answer. He preached that science was ruled by idea and technique and that the investigator discovered truth by activity alone.[1]

Another great scientist, transplant immunologist Peter Medawar, friend and mentor of young surgeons and future surgical investigators, explained his concepts about scientific creativity as dependent on previous work, unexpected findings followed by definitive experiments, and a certain degree of serendipity.[2] In their research, one would assume from those characteristics that the most knowledgeable and dedicated investigators are those with the most opportunities to reap the benefits of scientific creativity.

Surgeon-investigators, through history, have introduced innumerable important advances to medicine. Their discoveries enriched cardiac surgery, transplantation, vascular surgery, total parenteral nutrition, metabolic response to trauma, hormonal control of cancer, angiogenesis and genetics, to mention several of them. Clyde Baker, dedicated surgeon-investigator/scientist has recently summarized important developments in the history and philosophy of surgical research.[3] He emphasized the obstacles the surgeon-investigator must overcome before reaching a stable career, namely, time, economics and discrimination, as well as the inherent factors associated with the surgical persona. Surgeon-discoverers have in common the innovative spirit reinforced by time commitment and an urgent need for accomplishment.

As we reach the end of this writing, let us return to Charles Huggins philosophical thoughts and leave his words as a constant reminder of his wisdom and personal views:

> *Discovery is quite different from development. Discovery is science. It is for the few who enjoy meditation and reflection even during the activity of experimentation. Development is for the practical man and the big team. In discovering one becomes emotionally bound up in his problem. In the beginning of discovery there is nothing-only void. Then, comes the dream, and its high quality is the genius of research. The dream is a fantasy-a creation of the imaginative faculty.*

References

1. Huggins CB. The business of discovery in medical sciences. JAMA 1965; 194:1211-1215.
2. Medawar PB. Pluto's Republic. Oxford: Oxford University Press, 1992.
3. Baker FC. History and philosophy of surgical research in Surgical Research. In: Souba WW, Wilmore DW, eds. San Diego: Academic Press, 2001:1261.
4. Huggins CB. On medical investigation. Surg Clin North Am 1969; 49:455-457.

Section III. Surgery: Anesthesia

Chapter 32

Founders of Modern Surgery

Luis H. Toledo-Pereyra

It is not simple to identify the founders of a discipline, especially one associated with such a rich and profound past as surgery. If the modern era began after Isaac Newton (1642-1727), the Enlightenment (1740-1800), and the French Revolution (1789-1799), modern surgery started in the 19th century. The chief accomplishments of that century in surgery were the development of anesthesia, the emergence of antisepsis, and the establishment of appropriate training for surgeons. Given those achievements, Long, Wells, Morton and Jackson in anesthesia, Lister in antiseptics, and Halsted in surgical training constitute the founders of modern surgery.

Elie Metchnikoff (1845-1921)—a well-respected Russian zoologist, director of the Pasteur Institute (1895-1916), and 1908 Nobel laureate—published an important monograph dealing with the Founders of Modern Medicine. He observed:

> *The second half of the last century was marked by a profound transformation in medicine. This radical change took place both in the clinical as well as in the theoretical fields. Such an event must be set down as among the most important happenings in the evolution of human thought, and is deserving of our particular attention…the principal originators being Pasteur, Lister, and Koch.*[1]

Anesthesia

At the dawn of the 19th century, surgeons could not manage their two most important foes—pain and infection. Crawford Williamson Long (1815-1878), a doctor from Danielsville, Georgia, used ether for the first time on March 30, 1842, while extracting a small neck tumor painlessly from James Venable. Long did not publish his discovery until 1849. By then, William Thomas Green Morton (1819-1868), a Boston dentist, had used ether in an operation performed by John Collins Warren at the Massachusetts General Hospital in 1846. Morton had used ether during tooth extraction in 1844 at the suggestion of Charles T. Jackson, a chemistry professor from Harvard University. Morton and Jackson battled endlessly over their respective contributions, but Morton eventually shared the credit with Jackson. Horace Wells, a dentist who had given himself nitrous oxide on December 11, 1844, before having a tooth extracted, became the second to use anesthesia to prevent surgical pain. Morton is probably the main protagonist of the anesthesia story, because he undertook the steps necessary to bring anesthesia into the operating theater. Long did not publish his results, and so he cannot receive full credit. Wells and Jackson did not pursue anesthesia to its logical application as part of a well-planned surgical case.

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Antisepsis

By the middle of the 19th century, anesthesia offered a systematic approach to managing pain. But surgery had a second foe—infection. It was Joseph Lister (1827-1912) who applied Pasteur's germ theory to preventing infections. When Lister entered surgical practice, the conditions of surgery were deplorable—mortality was incredibly high. Lister offered a revolutionary technique that directly influenced outcomes. In March 1865, he used antisepsis successfully for the first time on an 11-year-old boy with a compound fracture of the left leg. He treated the wound with carbolic acid, and in other cases sprayed the wound with carbolic acid, cleaned the surgeon's hands with the same solution, and continued postoperative treatment with carbolic acid. His goal was to prevent the growth of microorganisms with a strong chemical. Without antisepsis, surgery would never have advanced beyond the unpredictable realm of inadvertent success.[2]

Surgical Training

By the close of the 19th century, consistent training of future surgeons still remained a puzzle. William Stewart Halsted (1852-1922), a New Yorker and Hopkins professor, implemented the first systematic and practical surgical training program. His program called for interns, chosen for one year; assistant residents chosen for several years; and a House Surgeon (Chief Resident), whose stay averaged two years. The entire program lasted an average of eight years. Halsted headed the service as the only staff surgeon and instituted an educational program that encompassed safety and effectiveness in the operating room and on the floors. He used experimental surgery to respond to some of the questions raised by doubters. He also established an animal lab where medical students could participate under the supervision of residents. Halsted was careful to apply scientific principles to surgery, including absolute hemostasis, avoidance of dead space, gentle care of tissues, and their perfect approximation without tension.[3] Generations of young surgeons received this training and went on to fill important positions in American institutions. Halsted's research and principles fully permeated the world of surgery.[2]

Though many contributed to our modern surgical practice, these founders of modern surgery were innovators in the control of pain, the prevention of infection, and the training of surgeons. We owe them much of our own success.

References

1. Metchnikoff E. The Founders of Modern Medicine: Pasteur, Koch, Lister. New York: Walden Publications, 1939.
2. Toledo-Pereyra LH. Maestros de la Cirugia Moderna. Mexico: Fondo de Cultura Economica, 1996.
3. Halsted WS. The training of the surgeon. Bull Johns Hopkins Hosp 1904; 15:267.

Chapter 33

Pioneering Steps in Anesthesia

Erik B. Loucks

On October 16, 1846 the medical community was introduced to general anesthesia. In the most extraordinary way, the gifted American painter, Robert Hinckley, in 1882 depicted the first public demonstration of anesthesia by William T.G. Morton.

Anesthesia has been a major factor in the development of surgical technique and the management of pain during surgery. As with any outstanding discovery, there is a story about how its roots began to grow. The maturing of anesthesia technique involved several cultures and individual minds over the span of many years until it was introduced in the 19th century as a safe and effective tool. Since then anesthesia has continued to grow and develop into the integral part of medical care that it is today.

Anesthesia has been used in a raw form for thousands of years. The use of cold to numb pain is thought of as the first anesthesia attempt in early man. Opiates and herbal plants containing hyoscyamus and mandragora have been used for centuries to reduce pain during surgery. For example, Incas in South America used to chew on coca leaves, which released an active alkaloid into their saliva. They then would drip the saliva onto the surgical site (often the head for trephination of the skull) in order to numb the region. Alcohol and barbiturates have traditionally been used to make patients oblivious to painful procedures. Until the mid-19th century, however, no method of anesthesia had been found that was safe and an effective way to temporarily deny the sensation of pain.

Initial steps towards modern anesthesia began with the work of Paracelsus, a Swiss physician and alchemist, in the mid-16th century. He mixed sweet oil of vitriol (now known as the anesthetic diethyl ether) into fowl feed and found that "it is taken even by chickens and they fall asleep from it for awhile but awaken later without harm."

The discovery of nitrous oxide gas in 1772 by Joseph Priestly was another major step in anesthesia history. This was initially used as "laughing gas" in social frolics and instilled giddiness and euphoria in the people breathing it in and amusement in those watching them. Humphrey Davy (1778-1829), an exceptional chemist and physiologist, gave the first insight into its use for anesthesia. After inhaling nitrous oxide to relieve a headache and toothache, he stated, "As nitrous oxide in its extensive operation appears capable of destroying pain, it may probably be used with advantage during surgical operations in which no great effusion of blood takes place." No one looked further into his suggestion, however, for many years.

A subsequent step towards modern anesthesia came in 1824 when Henry H. Hickman performed animal studies in which he introduced "suspended animation"

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

in animals by inhalation of carbon dioxide. The animals became temporarily unconscious through asphyxiation and were oblivious to surgical pain. He tried to introduce this asphyxiation technique to the scientific community by presenting his findings to the one scientific publication at that time, the *Transactions of the Royal Society*, but fortunately was unable to persuade them to help bring it into clinical use.

A safe but less effective method of removing pain sensation in patients came from John Eliotson (1791-1868) who introduced *mesmerism*. Although many successful operations were performed in mesmerized (or hypnotized) patients, the scientific community remained skeptical of its surgical value.

As time passed into the early 19th century, the medical profession came to a point at which knowledge of anatomy and surgical techniques had reached a somewhat mature level. The three main anesthetics, nitric oxide, ether, and chloroform, had been discovered by 1830s but not tested in terms of their anesthetic value. Medicine now seemed ready for the introduction of effective anesthesia. The 1840s were a time of rapid advancement, and the worldwide introduction of anesthetic agents that safely and effectively removed patients from pain sensation during surgery.

Crawford Long (1815-1879) first successfully used sulfuric ether to anesthetize several patients for minor surgeries in 1842. Dr. Long did not immediately realize the importance of his discovery, however, and did not publicize his findings for years, until after others had demonstrated the importance of ether anesthesia.

Dr. Horace Wells (1815-1848) was next to test the potential of anesthesia, this time using nitrous oxide. During a laughing gas frolic, he noticed that one intoxicated person cut his leg, yet did not feel any pain. Consequently, he had one of his own teeth removed the next day while under the effects of nitrous oxide and felt no discomfort. Being a dentist, he then successfully removed several patients' teeth using nitrous oxide. Satisfied with the results, he talked to Dr. John C. Warren, who arranged for a public demonstration of the anesthesia to a Harvard medical class in 1844. Unfortunately, the patient yelped during the tooth extraction, and Dr. Wells was booed (although following the surgery, the patient admitted that he felt no pain). Because of this, surgical anesthesia waited 2 more years before it was publicly embraced.

William T.G. Morton (1819-1968) a friend and associate of Horace Wells, began testing sulfuric ether as an anesthetic agent. Dr. Morton previously had invented a dental prosthesis which was very painful to insert. He was encouraged by the possibility of preventing discomfort in patients undergoing surgery. Following testing ether in animal subjects, Morton went on to perform several successful tooth extractions in patients. After demonstrating many surgeries to Henry H. Bigelow, a surgeon at the Massachusetts General Hospital, Dr. Morton received an invitation by John C. Warren to publicly demonstrate his technique to a Harvard Medical School class on October 16, 1846. On that day, some time after the procedure was scheduled to start Dr. Morton rushed into the operating theatre late holding a glass reservoir whose construction had just been finished that morning. The reservoir was designed to vaporize ether based on the drawover principle of vaporization. He successfully anesthetized the patient, Edward Abbott, following which Dr. Warren ligated a congenital venous malformation of the left cervical triangle.

Since October 16, 1846, now referred to as "ether day," anesthesia has developed into an integral part of surgery. With the advent of safer, more effective anesthesia, through improvements in administration apparatus and monitoring systems, and through the design of new anesthetics based on an understanding of their pharmacokinetic and pharmacodynamic effects, anesthesia has reached a point at which it is an exact science that is able to reliably negate pain in patients undergoing surgery.

It is said that three important medical developments have allowed surgery to expand from an art form into the powerful science that it is today: anesthesia in 1846 to nullify the sensation of pain; asepsis in 1879 to eliminate infection; and a sense of medical professionalism that facilitated scientific investigation and the sharing of knowledge within the profession. Without any one of these components, surgery would not be as effective a tool. The founders of anesthesia deserve true credit for helping to bring investigative surgery to where it is at in the present age.

References

1. Camac CNB. Classics of Medicine and Surgery. New York: Dover Publications, 1959.
2. Keys TE. The History of Surgical Anesthesia. New York: Dover Publications, 1963.
3. Nuland SN. The Origins of Anesthesia. The Classics of Medicine Library. Birmingham, Alabama, 1983.

Section IV. Surgery: The Encounter with Transplantation

Chapter 34

Organ Transplantation: From Myth to Reality

Hossein Shayan

Success in transplantation—the transfer of living tissue from one location to another in order to restore normal function or structure—has only been achieved in the past half century. The idea of transferring body parts to strengthen the powers of the recipient, however, has been stimulating the imagination of humankind for several millennia. Ample examples of chimeric gods and heroes with organs from different species are found in the Greek mythology. There are also examples of auto transplants in the New Testament, like the story of Jesus of Nazareth restoring a servant's ear, which was cut off by Simon Peter's sword. Also noted are the stories of Saint Peter reimplanting the breasts of Saint Agatha, which were pulled off during torture, and of Saint Mark reimplanting a soldier's hand, which was amputated during battle.[1] Perhaps the most famous of the legends is the extraordinary description of a cadaveric whole-limb allograft described in Jacopoda Varagine's Leggenda Aura in 348 A.D. In the "miracle of the black leg," the twin saints Comas and Damian replaced the gangrenous leg of the Roman deacon Justinian with a leg from an Ethiopian man who had been recently buried.[2]

The most primitive evidence of tissue transplantation can be found in the prehistoric archeological records from the Bronze Age.[3] In the skulls from this era, there are bone grafts used as part of the ancient practice of trephination. Trephination refers to the removal of a circular disc of bone from the calvarium in an effort to relieve intracranial pressure. The bone, which was placed back in the calvarium at a later date, represents an example of an orthotopic auto graft.

Other evidence of ancient experimentation with transplantation has been found in archeological specimens worldwide from Egypt, China, and India. A detailed description of skin grafts from chin used for nasal reconstruction has been found in a Hindu text as far back as 700 B.C.[4]

During the 15th century, techniques of and consequently prognosis for skin grafts improved considerably. Notably, in the 1590s a famous Italian surgeon named Gaspare Tagliacozzi used an upper arm flap to do reconstructive surgery on a person who had lost his nose. Tagliacozzi's procedure for nasal reconstruction is still in use and is referred to as the Italian Method. Remarkably, Tagliacozzi seemed to be aware of the individual differences in patients influencing the success of their allografts, as concluded in his treatise "De CurtorumChirurgiaperlnsitionem": "The singular character of the individual entirely dissuades us from attempting this work on another person. For such is the force and power of individuality, that if any one should believe that he could grounded in physical science".[1]

Historic reports suggest that grafting of teeth was done on humans beginning in the 17th century. Later, an 18th-century Scottish surgeon named John Hunter

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

reported success in transplanting human teeth into the highly vascularized comb of a cock, grafting a cock's spur into its comb, and transplanting cock testes into a hen. He also had some success in experimenting with Achilles tendon autografts. By the turn of the twentieth century, experiments with grafts from skin, tendons, thyroid, nerves, cartilage, adipose tissue, corneas, adrenal glands, ovaries, intestinal tract, urinary tract, and muscle had been reported.[3]

In 1804, G. Baronio reported successful allotransplants and xenotransplants of sheepskin; however, many investigators were unable to duplicate his results at that time. Much to the credit of the techniques described by Reverdin (1869) and Thiers (1874), by the end of the century skin grafting had become a therapeutically acceptable procedure. Despite the popularity of these techniques, the long-term survival of the grafts remained infrequent but nonetheless feasible. A famous case of a successful allogenic skin graft involves Sir Winston Churchill. In 1898 during the Sudanese war, Churchill was asked to donate a piece of skin from his arm to an injured fellow officer. Later, Churchill described the event in his own words: "A piece of skin and some flesh about the size of a shilling from the inside of my arm. This precious fragment was grafted to my friend's wound. It remains there to this day and did him lasting good in many ways. I for my part keep the scar as a souvenir".[1]

The first widely accepted use of tissue transplantation as a therapeutic measure was for the treatment of corneal injuries. In 1837, the Irishman Samuel Bigger successfully transplanted a full-thickness cornea into the blind eye of a pet gazelle. Continued refinement of the procedure eventually led to the first successful human transplant in 1906.[1]

Transplantation As a Multidisciplinary Science

According to our current knowledge of organ transplantation, a successful transplant only occurs under precise and well-defined conditions. For this to happen the recipient and the donor must remain in an optimal state of health. Organs and vessels must be relocated and reanastomosed meticulously to ensure tissue and host viability. Postoperatively, a carefully balanced immune status must be established such that both infection and rejection of the donor tissue are prevented. Thus, the science of transplantation is a multidisciplinary science, and historically its advancement has depended on progress in various fields of medicine, such as anesthesiology, surgery, and immunology. Thus the following milestones in these fields have been essential for the dawn of modern transplantation.

In 1846, Dr. William Morton used ether for the very first time during a tumor removal surgery. Ether was synthesized as early as 1540 by an alchemist named Valerius Cordus. In the 1800s experiments were conducted by surgeons and dentists to test its efficacy in inducing chemical anesthesia. Half a century later the myth of painless surgery was finally realized by Morton.[5]

Another notable advancement was defining the principles of antiseptic technique, by Lister in 1865. During the last part of the 19th century, the mortality rate associated with abdominal surgery was remarkably reduced using Lister's principles of aseptic surgery. In addition, Lister was also responsible for inventing suture needles, bandage scissors, and an aortal tourniquet.[5] Around the turn of the century, the French physician Alexis Carrel developed hemostatic methods that made organ transplantation technically feasible. By designing the arterial clamp, Carrel was able to temporarily interrupt blood flow through the clamped vessel, allowing for more stable vascular procedures. Using this device, between 1902 and 1912, Carrel and Guthrie were the first to anastamose vessels together.[2]

The biggest impact on revolutionizing the science of transplantation must be attributed to the advances in immunology and immunogenetics. Even though the study of immunogenetics and immunosuppression is less than half a century old, for centuries scientists were aware of the existence of individual differences in patients that governed the outcome of their grafts. Alexis Carrel in 1910 specifically addressed this issue: "Should an organ, extirpated from an animal and replanted into its owner by a certain technique, continue to function normally, and should it cease to function normally when transplanted into another animal by the same technique, the physiological disturbance could not be considered as brought about by the organ, would be due to the influence of the host, that is, the biological factors".[3] Despite this awareness, the 1930s witnessed a worldwide decline in immunology-related research. Discouraged by the continual failure of allografts, surgeons concluded that except for corneal grafting, organ transplantation was not possible due to the uncontrollable rejection process. Fortunately, this decline in interest was only temporary. With the arrival of the Second World War, the study of immunology as related to skin grafting was accentuated in order to treat many burn victims of the war. Notably, the War Wounds Committee of the British Medical Council assigned a young Oxford graduate named Peter Medawar to investigate the problem of allograft rejection. Medawar, who is now known as the father of modern transplant immunology, demonstrated that the allograft rejection was an immunologic phenomenon.[6] From then on, many scientists strived to find methods of suppressing the immune system in order to reduce the rejection rate. Tissue typing—matching of donor tissue antigens with those of the recipient's—was first used as a measure of reducing the immune response, shortly after the discovery of one antigen group by Jean Daussat in 1958. Other methods for depressing the immune response included radiation-induced and chemical immunosuppression. Total-body irradiation was first introduced in 1959 to suppress kidney allograft rejections from living donors. While this method was effective in reducing the lymphocyte count in the recipient, its side effects of serious susceptibility to infection and neoplasia outweighed its benefits. Based on 1950s documented reports on the effectiveness of adrenal steroids in combating various immunopathological states, Thomas Starzl began experimenting with cortisone and its synthetic derivative prednisone as chemical immunosuppressants in the early 1960s. Along with several other investigators such as Hume and Marchioro, Starzl demonstrated that prednisone could reverse renal allograft rejections. In the early 1960s, the British researcher Calne initiated the first clinical trial of azathioprine as another chemical immunosuppressant. This trial was based on a 1959 observation by Schwartz and Dameshek that antibody synthesis in rabbits could be suppressed using azathioprine. Between 1962 and 1964 Starzl experimented with an immunosuppressant cocktail containing both prednisone and azathioprine. While this approach increased the renal allograft survival, the side effects remained a major obstacle. The long-awaited breakthrough occurred in 1972 with the discovery of cyclosporine by Swiss biochemist Jean-Franc,ois Borel.
34 This fungal byproduct was given to human patients in the late 1970s. Incredibly, in the preliminary studies, the viability of liver allografts increased from 18% to 68% in response to cyclosporine.[4] Still in use today, cyclosporine is not without its side effects. With the cocktail approach, which includes the use of both steroids and

azathioprine, to date cyclosporine has offered the most reliable and the least harmful immunosuppressive measure for transplantation.

Birth of Modern Transplantation

In the late 1930s, following remarkable advancements in anesthesiology, surgery, and immunology, the rise of modern transplantation began. In 1936, Voronoy, a Russian surgeon, performed the first renal allograft in history. Unfortunately, the patient only survived for 2 days following the operation. Then in 1947 in Boston, Hufnagel implanted the kidney of a dying woman into a young pregnant woman suffering from a serious uterine infection. After providing enough time for the pregnant woman to recover from her infection, the donor kidney was removed successfully. In 1950 Ruth Tucker survived a renal allograft for 11 months without the use of immunosuppressants. The donor was a nonrelated woman of the same age and blood type. The autopsy confirmed that the graft was slowly rejected.[4]

As previously mentioned Medawar's findings during the Second World War brought new excitement and hope to transplant research. In particular, following the observation that skin grafts succeeded only when performed between identical twins, Medawar and his colleagues postulated that a kidney transplant between identical twins would also endure. In a landmark operation in 1954, Joseph Murray and John Merrill proved Medawar's hypothesis to be correct by transplanting a kidney into Richard Herrick from his twin brother. Herrick died of cardiovascular disease 8 years later but no evidence of rejection was ever seen postoperatively. In 1956 Murray and Merrill continued their success, transplanting a kidney into Edith Helm from her twin sister. Helm, the longest living survivor of a whole-organ transplant, went on to become a mother and grandmother and to live actively well into the 1990s.[1]

In 1967 in South Africa, Christian Barnard transplanted the heart of a young woman who died in a car crash into 55-year-old Louis Washkansky. This marked the first successful cardiac transplant in history, though Washkansky only lived for 3 weeks after the surgery. The news of this operation shocked the world and it introduced the concept of transplantation to the public minds; prior to that, transplant was an experimental approach known only among the scientific and medical community.[4] In the same year, Thomas Starzl performed the first successful liver transplant at the University of Colorado. The following year, Denton Cooley performed the first successful heart transplant in the United States. The year 1968 was also when the first successful bone marrow transplant in humans took place.[6] Finally, on October 26, 1984, Leonard Bailey shocked the world by implanting a baboon's heart into a dying infant, Baby Fae. Even though Baby Fae lived only 20 days after surgery, Bailey's attempt introduced the world to the prospect of xenotransplan-tation as a key solution to the shortage of organ donation.

The 20th century has seen the fascinating journey of organ transplantation from an ancient myth to a routine therapeutic measure. Alongside the evolution of the scientific principles, this journey has also witnessed the metamorphosis of society's perception, ethics, and mentality toward transplantation. As we enter the new millennium, the prospects of molecular cloning and tissue engineering open new avenues in the field of transplantation. These prospects are expected to redefine our management of many terminal illnesses, as well as our current ethical boundaries, in the near future.

References

1. Duquesnoy RJ. History of Transplant immunobiology 2000. <http://www.tpis.upmc.edu/tpis/imuno/wwwH/STpart.htm>
2. Gutkind L. Many Sleepless Nights. New York: WW Norton 1998.
3. In: Sabiston Jr DC, ed. Textbook of Surgery: The Biological Basis of Surgical Practice. 12th ed. Philadelphia: WB Saunders, 1981.
4. Bergan A. Ancient myth, modern reality: A brief history of transplantation. J Biocommun 1997; 24(4):2-9.
5. Lehrer S. Explorers of the Body. Garden City: Doubleday, 1979.
6. Starzl TE. History of clinical transplantation. World J Surg 2000; 24:759-782.

Chapter 35

The Origin and Future of Transplant Surgery

Erik B. Loucks

Throughout history, art has been an expression of society's thinking during each era of time. This is the case in Ambrosius Francken the Elder's portrayal of the first legendary transplantation, performed by Cosmas and Damian, the patron saints of surgery. St. Cosmas and St. Damian were twin brothers who were born in Arabia, medically trained in Syria, and practiced medicine and surgery in Cilicia and throughout Asia Minor. Throughout their lives they were dedicated to healing people and to the Christian faith. The brothers, through their seemingly miraculous surgical skills and their humble way of life, gained widespread trust and admiration, and thus inspired many people to embrace Christianity. Christianity at this time was seen as a threat to the Roman Empire. Consequently, Emperors Diocletian and Maximo sought to suppress the influence of the two brothers and attempted to convert them away from Christianity. Following the failure of this, they attempted to drown, burn, and stone the brothers to death, yet according to legend each attempt was thwarted by divine intervention. Eventually the brothers were decapitated in 287 A.D. and buried in a tomb in Giro. Following their death, people still came to their grave to pray and ask for healing of their ailments. One of the individuals said to be healed was Emperor Giustuniano. In appreciation for what they did, he decreed that a magnificent basilica be constructed at their grave. At this basilica, it became customary for people to pray to Cosmas and Damian for healing of their ailments, and then sleep in the basilica in hopes that the saints would intercede with God and heal them while they slept. One evening, around 348 A.D., the sacristan of the church, who was suffering from a severely gangrenous leg, performed this custom, called "incubation." It is said that during the night, Cosmas and Damian appeared and amputated his leg. They then surgically replaced it with the leg of another person who had died that same day. Upon waking, the sacristan stood up and felt that his leg was feeling much better. He looked down at it and saw that it was not his, but that of another person—someone with dark skin. He went out and proclaimed to the people the miracle that had happened to him, and upon seeing his amputated leg lying beside the body of an Ethiopian Moor, all believed what had occurred.

The Miracle of the Black Leg has inspired many paintings. Ambrosius Francken interpreted the scene-taking place in a hospital in the Netherlands. He placed the center of attention on the surgical procedure itself. Cosmas and Damian are standing on either side of the patient, after having just amputated his leg. The severed leg is lying on the floor in front of them, along with a saw, some bloodstained linen, and a copper basin filled with coagulated blood. The scene is representative of the hospital conditions during the late 16th century when this painting was completed. Where the scene differs from any hospital scene during that era, or in any era since that

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

time, is that the saints are preparing to graft another person's leg onto the patient's stump. We can see that one of the saints is holding the donor leg, while the other is steadying the stump ready for transplantation.

Since 348 A.D., science has been working hard to once again perform this transplantation that was mythologically practiced long ago. The development of Alexis Carrel's new suture technique allowed for the first autotransplantations. However, although the surgical technique then seemed possible, donor organs were rejected by the body from an undetermined biological process. Sir Peter Medawar provided the next important contribution to organ transplantation in 1951 by finding that cortisone administration delayed rejection of the guest organ. The most powerful immunosuppressive agent, cyclosporine, was introduced in 1978 by R.Y. Calne and his associates and provided the immunosuppression required for long-term acceptance of transplanted organs. With these and many other contributions to science, transplantation has gone from the first successful human kidney transplantation by J.H. Harrison and J. Murray in 1954 to the now almost routine transplantation of kidney, heart, liver, pancreas, and bone marrow. Today's society seems to be approaching a time when Cosmas's and Damian's level of transplantation may be possible. It may be that with a little more investigative surgery research and consecration to the patrons of surgery, we will soon bring the mythological past into the future of transplantation surgery.[1,2]

References

1. Tilney NL. Transplant. From Myth to Reality. New Haven: Yale University Press, 2003.
2. Adler RE. Medical First. From Hippocrates to the Human Genome. Hoboken: John Wiley and Sons, 2004.

Chapter 36

The Long Journey to Cardiac Transplantation

Janet Fisher and Mark Trump

It all began with Pien Ch'iao, a Chinese physician born in 430 B.C. As a celebrated surgeon of his time, he was introduced to two men who he found to have "unbalanced energy." He pointed out to them that if their hearts were exchanged, equilibrium would be restored. His men agreed and strong narcotics were administered that left them unconscious for 3 days. Their chests were cut open and hearts exchanged. Postoperatively, "powerful herbs" were administered to allow acceptance of the new organs. While likely myth, this illustrates the human intrigue with organ transplantation as a cure for disease and a very early knowledge of rejection.[1]

During the next two thousand years, countless experiments and clinical trials were performed, leading to our modern understanding of transplantation. This article reviews the significant innovations, procedures, and some of the societal and political hurdles that had to be overcome to allow for today's successes.[1-13]

The millennia leading up to and including the 18th century brought the concept of allografting to experimental surgery. The 1800s saw the advent of the free graft. Paul Bert, one of the mavericks of this science, demonstrated in 1863 that angiogenesis from the host to graft was required for graft survival. It would take more than 40 years for the development of an effective technique for vascular anastomosis.[2] In the meantime, Ullman avoided the problem of anastamosis by using prosthetic tubes. He was the first to perform auto-, homo-, and heterotransplantation of kidneys, but tactfully avoided any discussion of rejection.[3]

Alexis Carrel and Charley Guthrie, using this early knowledge as well as the technique of fine continuous suture for vascular anastomosis, which Carrel developed, were able to perform successful vascular anastomosis without thrombosis, hemorrhage, or stenosis. This enabled them to graft a variety of tissues and organs, the most phenomenal of which was the transplantation of a dog heart onto the neck of another dog in 1905. Contractions in the transplanted heart continued for twenty-one minutes, until coagulation occurred.[5] After winning the Nobel Prize for this work in 1912,[6] Carrel went on to develop techniques for cardiac perfusion with the goal of developing cardiopulmonary bypass, a project he worked on with the renowned aviator Charles Lindbergh.[2,3,5]

Many scientists were involved in the quest for functional cardiac transplantation. In 1933, Mann et al. transplanted a heart onto the neck of a dog, with the heart functioning for 8 days. Other scientists to try heterotopic transplantation were Ognev in 1947, Sinitsyn in 1948, Marcus in 1951, and Downie in 1953.[7] Interestingly, in Russia, Demikhov had been doing intrathoracic transplants since 1946, but knowledge of his work was limited outside of Russia because of war and the Iron Curtain.

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Demikhov, a Russian scientist born in 1916, was the first to complete intrathoracic transplantation of the heart alone, lung alone, and heart and lungs together in a warm-blooded animal. On 30 June 1946 was the first intrathoracic heart—lung transplant; the dog survived 9 h and 26 min. What makes this operation more incredible is that it was done without cardiopulmonary bypass or hypothermia. Demikhov was also the first to perform an experimental coronary artery bypass operation with success. Also to his credit, he designed the first mechanical cardiac substitute at the age of 21 and was one of the first to use the vascular stapling device in experiments.[2-4,6]

As the technical aspects of transplantation were evolving, it became clear that success would be limited without advancement in the understanding of tissue rejection. The field of immunology was in its infancy in the 19th century and was progressing quite exclusively from transplant surgery. It would be many years until the two fields would combine their knowledge to begin to solve the problems of transplantation and rejection. When Von Behring discovered that a toxin injected into an animal would initiate a response by the body to neutralize the toxin (i.e., antibody formation), he laid the groundwork for present-day immunology. Paul Ehrlich, in 1897, set the stage for modern day immunochemistry by establishing that the specificity and interactions between antibody and antigen depended on the laws of structural chemistry.[4] In 1901, Landsteinerwon the Nobel Prize for demonstrating that humans can be divided into classes based on their sera agglutinins specific to their erythrocytes. Thus was born the ABO system of blood grouping and later the Rh system.[3] In 1938, Peter Goerer showed that some antigens isolated on red cells in different strains of mice could also be found on cells in other tissues. He felt these to be genetically determined and that an incompatibility between these antigens was the cause of graft destruction in transplantation. Indeed, the histocompatibility antigens were found to be genetically controlled with multiple alleles designated H-2 in the mouse and later found to be analogous to the human leukocyte antigen (HLA) A, B, and C. These were expressed both in the blood as well as on tissue cells, thus permitting a method for testing susceptibility of donor tissue to host rejection.

A crucial finding on rejection was achieved by Homan in 1924. Homan demonstrated that a single donor's skin graft applied to a burn patient was rejected more rapidly with the second application. Vonroy in 1933 transplanted the first human kidney. The patient died in two days. Vonroy made six more unsuccessful attempts. Also, Medawar was considering Homan's results on foreign skin grafts and believed that they followed the rules of immunologic specificity. Medawar applied the concept of "cellular immunity" to tissue transplantation and immunologic tolerance.[2,5] This led to the concept of cell-mediated immunity, which has now been shown to be a key factor in the rejection of allogenic tissue transplants.

With the successful transplantation of a kidney on December 23, 1954, between monozygotic twins, transplant surgery became a valid procedure if the complication of rejection was removed. However the opportunity to transplant genetically identical organs was obviously limited. In 1958, Murray and Hamburger performed renal transplantations, and attempted to suppress rejection in humans by using total-body irradiation. While this prolonged acceptance of the graft, rejection was still inevitable. Thus, they attempted 2 doses of 450 rad with greatly improved survival. This

is now acknowledged as the beginning of immunosuppression. Although radiation was successful, it was a nonselective agent and therefore a great deal of morbidity was associated with it. Baker combined nitrogen mustards, cortisone, and splenectomy in 1952 to prolong the survival of canine allografts. In 1959 Schwart and Dameshek discovered that 6-mercaptopurine could suppress the immune response of rabbit to human serum albumin and to rabbit skin allografts. Then came the development of azathioprine and glucocorticoids, which remained the conventional therapy for nearly 20 years until cyclosporin A was introduced. Cyclosporin, a fungal metabolite, was found to inhibit maturation of immune elements; however, its was not recognized as an immunosuppressive agent until Borel combined it with azathioprine and steroids to make it very effective against rejection. This was a major breakthrough, since now there was a medication that provided immune suppression without paralyzing the entire immune system.[2,3,7,9]

In addition to immunosuppression, the further development of cardiac transplantation required more sophisticated operative support. Many of the intraoperative support advancements were developed for nontransplant cardiac surgery, such as VSD (ventricular septal defect) or valve repair. The practice of hypothermia was developed largely in Canada. In 1950, Bigelow in Toronto showed that a reduction in body temperature to 30°C extended the period a brain could remain anoxic without permanent damage from 3 min to 10 min. Swan, in Denver, used ice baths to achieve cooling. Brock developed a technique of veno-venous cooling where blood was removed from the vena cava and cooled extracorporally.[8] The Lillehei group at Minnesota introduced significant advances in reaching successful open heart surgery under cross-circulation, maximal oxygenation with the De Wall's bubble oxygenator and many other important developments.[9]

Coronary bypass development was also crucial. Gibbon in Philadelphia, Bjork in Stockholm, and Melrose of London were all involved in the development of heart—lung machines. Gibbons developed stationary vertical screen oxygenation. Bjork developed a set of stainless-steel discs that rotated in a bath of blood. Melrose improved Bjork's technology by rotating an inclined drum through which blood slowly flowed down, allowing better oxygenation. The definitive membrane oxygenator was developed by Ghadiali in the United States.[8]

Thus in the first half of the 20th century three significant events brought cardiac transplant surgery closer to the realm of reality: the development of vascular anastomosis, the advent of potent immunosuppressant drugs, and Gibbon's development of the cardiopulmonary bypass technique.

The first cardiac transplant involving a human was in 1964. Hardy performed a cardiac xenograft from a chimpanzee to a 68-year-old patient in cardiogenic shock. The patient lived 1 h, and death was said to have been caused by inadequate venous return due to the small size of the heart.[2,7]

The work of Hardy et al. paved the way for Barnard, in South Africa, to perform the first successful cardiac transplant in 1967. He replaced the damaged heart of a 54-year-old male with that of a 24-year-old female killed in an auto accident. Both patients were placed on cardiopulmonary bypass. The heart was cooled to 16°C by perfusion and then removed and cooled topically. It was placed orthotopically by suture of the atrial cuffs, aorta, and pulmonary artery, and lasted 18 days, when the patient died of pneumonia.

Three days after Barnard's legendary transplantation, a Brooklyn surgeon, Adrian Kantrowitz, transplanted a heart harvested from a 2-day-old anencephalic donor into a 17-day-old infant dying of HLHS.[10,11] Unfortunately, the recipient died of metabolic and respiratory acidosis within 7 h.

In January 1968, Barnard performed his second heart transplant; on a 58-year-old who was discharged from the hospital and survived for 20 months, eventually dying of chronic rejection. This "success" created a great deal of enthusiasm, and in 1968 alone there were more than 100 cardiac transplantations performed at more than 60 centers. All had poor survival results because of rejection and heavy immunosuppression. Therefore in the following years there was an exponential decline in procedures to where less than 20 were performed in 1970.[2,3,5,7]

Although Barnard's second transplant was considered a relative success, the mortality rate overall among transplant recipients worldwide was 60% by the eighth postoperative day. This led to a moratorium on the procedure until cyclosporin became used for heart transplants in the early 1980s.

Transplantation and cardiac replacement continued to develop. Lillehei performed the first heart-lung transplant in a 13-day-old human who survived for 6 h. Reitz later performed the first successful heart-lung transplant with the assistance of cyclosporine.[3,10] On October 26, 1984, a baboon heart was transplanted into a 12-day-old girl know as Baby Fae.[11] In March 1983, dentist Barney C. Clark was the first recipient of an artificial heart and survived 112 days.

With the development of heart transplantation, and its increased use, came ethical debate and public concern regarding the source of donors. In Britain, the public demand for formalization and accountability of the process led to a formal description of brain death that is still used to this day.[8] More recently, with more successful transplantation outcomes, the limitations come from lack of donors. This has led to the search for alternatives to transplantation for heart failure.

Some of the new alternatives to heart transplantation include partial left ventricular resection, dynamic cardiopolasty, and mechanical support.[12] Partial left ventricular resection with mitral valve replacement was developed and pioneered by Brazilian cardiologist Randas V. Batista in the late 1980s. Dynamic cardiomyoplasty, introduced in 1985, consists of mobilizing and harvesting the latis-simus dorsi muscle, relocating the muscle to the anterior chest cavity while retaining the neurovascular pedicle, and finally implanting pacing sensing electrodes in the skeletal muscle and myocardium. The skeletal muscle is trained with the myostimulator from the second to the eighth postoperative week. The left ventricular assist device is used as a bridge to transplantation.[12]

Today, the one-year survival rate for heart transplant recipients is greater than 90%. While transplantation has become more successful over the last several decades, there are still significant improvements to be made. Improved organ preservation techniques and development of more effective immunosuppression are two areas that offer great research opportunities and would result in decreased mortality and morbidity of the transplant recipient. However, the lack of organ availability is a tremendous social, cultural, and economic hurdle that needs to be crossed.[13] Without available hearts, cardiac transplant will once again become myth.

References

1. Kahan BD, Ch'iao P. The legendary exchange of heart, traditional Chinese Medicine, and the modern era of cyclosporine. Transplant Proc 1988; 20(2 suppl 2):3-12.
2. Moore FD. The history of tranplantation—A lesson for our time. In: Organ Transplantation and Replacement. Philadelphia: JB Lippincott, 1988:3-16.
3. Flye WM. History of transplantation. In: Principles of Organ Tranplantation. Toronto: WB Saunders, 1989:1-17.

4. Baldwin JC, Wolfgand TC, Shumway NE et al. Cardiac transplantation. In: Principles of Organ Transplantation Toronto: WB Saunders, 1989:385-401.
5. Kahan BD, Troncoso P. Introduction to solid organ transplantation. In: Transplant Infections. Philadelphia: Lippincott-Raven, 1998:1-11.
6. Konstantinov IE. A mystery of Vladimir P. Demikhov: The 50th anniversary of the first intrathoracic transplantation. Ann Thorac Surg 1998; 65:1171-1177.
7. Reitz B. The history of heart and heart-lung tranplantation. In: Heart and Heart-Lung Transplantation. Philadelphia: WB Saunders, 1990:1-11.
8. Cleland WP. The evolution of cardiac surgery in the United Kingdom. Thorax 1983; 38:887-896.
9. Johnson SL. The History of Cardiac Surgery 1896-1955. Baltimore: Johns Hopkins Press, 1970:137-158.
10. Cerilli JG. Highlights of recent progress in tranplantation. In: Organ Transplantation and Replacement. Philadelphia: JB Lippincott, 1988:16-37.
11. Breo DL. Two surgeons who dared are still chasing their dreams. J Am Med Assoc 262(20).
12. Starling RC. Radical alternatives to transplantation. Curr Opin Cardiol 1997; 2:166-171.
13. Bahnson HT. Transplantation of the heart: Reminiscences of the past and inklings of the future. Ann Thorac Surg 1997; 64:1561-1563.

Chapter 37

The Man and the Father of Transplantation

Luis H. Toledo-Pereyra

The scientific accomplishments of Alexis Carrel (1873-1944) are well known to the surgical and medical community. His life has been well narrated,[1-4] describing both his scientific prowess and his extraordinary surgical research in detail.[4-7] Yet little is known about his personality, his character, and his beliefs. Little is known about Carrel the man, the writer of *Man, The Unknown*, the man who explored the human being and through his writings revealed himself. This article briefly describes the soul and spirit of Alexis Carrel and explains why he should be considered one of the founders of modern surgery as well as the father of transplantation.

In 1922, Eli Metchnikoff, the noted, Nobel prize-winning Russian zoologist and director of the Pasteur Institute, published a book entitled *The Founders of Modern Medicine*.[8] In this book, he proposed that Pasteur, Lister, and Koch be recognized as the preeminent founders of modern medicine. No doubt these scientists belong in the pantheon of medical heroes. In addition, it is fitting to begin a new classification as the founders of modern surgery and in this category to include another outstanding personality—Alexis Carrel, the genius who invented transplantation and vascular surgery. Through his dedicated and incredible work in vascular suturing, for which he won the Nobel Prize in Physiology and Medicine in 1912, Carrel demonstrated under experimental conditions and without anticoagulation that it was possible to maintain vessel patency for prolonged periods of time. He pioneered the detailed aspects of vascular techniques, which were responsible for the development of transplantation and vascular surgery; these included proper approximation, avoidance of endothelial injury, the use of delicate silk sutures embedded in oil substances to prevent vessel damage, the triangulation technique, and the eversion of the endothelial surface. Carrel perfected these technical accomplishments in animal surgery, where he exercised them in the transplantation of organs, in particular kidneys. His outstanding results had never been attained consistently before.[1-7] Because of his amazing pioneering contributions to transplantation and the opportunities he opened for others by elucidating the technical aspects of the procedure, Carrel should be considered the father of transplantation. For his extraordinary contributions to vessel suture techniques, Carrel should also be considered the father of modern vascular surgery.

The Making of Alexis Carrel

The making of Carrel the philosopher, the thinker, the intellectual, depended primarily on his family values, religion, society's influences, and the experiences of his early youth. Carrel grew up in a strong Roman Catholic atmosphere. He attended Jesuit schools and married a devout Roman Catholic widow (Anne de la

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Motte de Meyrie). Without a doubt, he was indelibly touched by all these circumstances of his rich experience. As a consequence, he held strong Catholic principles. He believed in God and the greatness of God's influence, as well as his desire to obey God's laws.[3] At the same time, he had numerous questions dealing with the presence of God, the divergence of mind from matter, the appearance of consciousness, and the role of courage, audacity, altruism, spirituality, and love.[4] According to Carrel, obedience to natural laws was fundamental, separation of good and evil was critical, and the understanding and acceptance of rules of conduct were basic.[3,4] He believed that asceticism and self discipline were the engines of inner satisfaction and superior enjoyment.[9,10] Spiritual development was of considerable importance to him, and he recommended solitude and prayer, even for short periods of time.[4] Though he readily accepted the important function of society and the immeasurable effects of love, he did not readily support the participation of women and minorities as equal partners. His view, not infrequently shaded during his times, cannot absolve his severely blurred social vision. The weak, the sick, the invalid, and the mentally retarded did not have a place in his world.[4] Carrel did not show any consolation for these poorly afflicted individuals—hard to accept today, when he was such a committed human being with a profound religious background. Carrel was an ardent student and supporter of eugenics and the belief in genetic superiority, predicated by Francis Galton (1812-1911), a cousin of Charles Darwin (1809-1882), who had an ardent student and supporter in Carrel.

The Writings of Alexis Carrel: Man, The Unknown

The best known and most controversial of all the writings of Carrel was his intellectual summit, *Man, The Unknown*. The book was published in 1935, 9 years prior to his death, when Carrel was 62 years old. Carrel spent several years writing this piece since he wanted to fully expose all the ideas that he had been ruminating on for many years.With influence from his friends in his philosophy group— Frederic Coudert, Father Cornelius Clifford, and Boris Bakhmeteff—Carrel embarked on the laborious voyage required for a book of this magnitude. In the words of Carrel, this book was written to preserve "the beauty of civilization and grandeur of the physical universe" by preventing the deterioration of man, which could be accomplished by utilizing "the gigantic strength of science".[9] Science was at the disposal of humanity; the issue was how to apply it best for the good of man's future and for the good of the entire world.

This book was an extraordinary philosophical work even though Carrel did not consider himself a philosopher, "only a man of science".[9] He wanted to describe the known and unknown of human behavior, to demonstrate what civilization was doing to man, and to underscore the significance of education for young people. At the same time, he was a declared racist who believed in the survival of the fittest, as Darwin had promulgated years before.[4,9] Carrel was not a perfect man but rather one who struggled to become a better person throughout his life. LeVay, in his book *Alexis Carrel, The Perfectibility of Man*, brilliantly captured the virtues and faults of this highly imperfect man.[4]

Spirit Versus Technology: The Hope of Our Time

The spirit, the soul, and the mystical were crucial to Carrel's philosophy. He asserted that the spirit of man was unique and should be preserved and enhanced. Understanding the soul and characterizing mysticism were not simple endeavors;

they needed full commitment to grasp the importance of their appropriate nurturing and expansion. According to Carrel, man should enhance his spirituality, his mysticism, his deep energies of individuality. He said, "We have treated man as a machine and neglected thought, morality, beauty and peace. We have amputated his moral esthetic and religious functions. We have forgotten the importance of ... either individuality or the constitution of the human being".[4,9]

Carrel did not support widespread industrialization. In fact, he deemed industrialization one of the evils of our time. Technology was good as long as it supported man's functions and capabilities and helped him to better understand himself. He said, "Modern civilization does not suit us because it is due to scientific advances not primarily designed to improve the human condition. We have pursued convenience, but the rate and rhythm of society have not been related to their human effects. Factories and cities deprive us of the real necessities of life. . . . Man, who should be the measure of all, is a stranger in the world he has created, because he is ignorant of his own nature and how best to develop it".[4,9]

These words confirmed the primary contentions of Carrel's philosophical principles and ideas. These words reveal Carrel as the philosopher, the thinker, the man, who understood human activities and projected them into a better world, the spiritual world, the world of our inner thoughts and moral principles: *The Hope of Our Time.*[3]

Reflections on Life: The Last Hope of Alexis Carrel

In 1952, *Reflexions sur la Conduite de la Vie*, the final unpublished work of Carrel, appeared in print for the first time due to the generosity and forthrightness of Anne Carrel, his wife. She understood the importance of disseminating the work of her distinguished husband, who dedicated his life to the improvement of generations of young people through the use of the best available science.[4,10] Anne Carrel explained why it was so important to publish this work: "My hope resides in the young who were the object of his preoccupation and of his affection. Some of them will feel the truth contained in these pages, unfinished as they are. They will help them in difficult times to push open those doors behind which a useful, perhaps even a happy life awaits them. In this hope I launch his ship on the wide ocean, hoping that she will find a good harbor though the pilot is no longer at her helm".[10]

In this book, Carrel restated his philosophical positions on improving the quality of life, considering the complete development of the positive hereditary characteristics, finding means to stimulate spiritual growth and mental development, "activities that manifest themselves especially in moral sense, judgment, robustness of spirit and resistance to folly".[10] Hawthorn Books, which published Carrel's book, indicated on its cover that he "offered a philosophy of hope for a world in which men can work together in peace of body, peace of mind and peace of soul".[10] Carrel's intentions were to draw out the best in every person, based on "the finest development of his hereditary power and his personality".[10]

Of particular importance is the last chapter of the book, which addresses the success of life. To be successful, we need to "transform ourselves and become capable of gradually transforming our environment and our institutions. Then at last we might be able to use the power of science to develop the inherited potentialities of our race in the best possible way and to build up, on the ruins of modern society, a world modeled on the true needs of human beings. ... The success of life implies the full accomplishment of our spiritual destiny, whatever it may be"[10] ... "the union with God and other human beings".[4]

The Future As Seen by Carrel

The great French surgical scientist saw the future as intimately associated with recognizing the present, advancing the knowledge of personal renovation (personal reconstruction being the utmost development, along with control of our weaknesses and defects), eliminating the morality of pleasure and poor control, stimulating the protection of the spiritual, and, above all, enhancing our communication and inspiring our activities with God.[10]

References

1. Malinin Tl. Surgery and Life: The Extraordinary Career of Alexis Carrel. New York: Harcourt Brace Jovanovich, 1979.
2. Toledo-Pereyra LH. Visionary mind of a surgical scientist: Marie Joseph Auguste Carrel. J Invest Surg 2002; 15:3-4.
3. Durkin JT. Hope of Our Time. Alexis Carrel on Man and Society. New York: Harper & Row; 1965.
4. Le Vay D. Alexis Carrel. The Perfectibility of Man. Rockville: Kabel Publishers, 1996.
5. Anaya-Prado R, Toledo-Pereyra LH. Alexis Carrel: Historia de un cirujano. In: Calderon M, ed. Fllosofia Qulrurglca, Mexico City: McGraw-Hill lnteramericana, 2001.
6. Langer RM, Kahan BD. Alexis Carrel's legacy: Visionary of vascular surgery and transplantation. Transpl Proc 2002; 34:1061-1065.
7. Stephenson Jr HE, Kimpton RS. America's first Nobel Prize in medicine or physiology: The story of Guthrie and Carrel. In: Stephenson Jr HE, ed. Boston: Midwestern Vascular Surgery Society and Hugh E. Stephenson Jr, 2000:1174.
8. Metchnikoff E. The Founders of Modern Medicine: Pasteur, Koch, Lister. New York: Waiden, 1939.
9. Carrel A. Man, The Unknown. New York: Harper and Brothers, 1935.
10. Carrel A. Reflections on Life. New York: Hawthorn Books, 1952.

Section V.
Other Historical Aspects

Chapter 38

British Colonial America

Luis H. Toledo-Pereyra

We know the names, but not the deeds of the first surgeons who reached British Colonial America in 1603, 1607, and thereafter.[1] Our professional ancestors in the Colonial period had no interest in writing or communicating their experiences of the surgeon's world. Surgeons of this era had little or no formal education and even less cultural knowledge. Members of learned professions esteemed surgeons as less than desirable and their status was clearly unappreciated. The surgeon's job was no more or less than the barber's position, than the barber-surgeon status of the times.[2]

It was not simple to reach North America in early colonial times. The enormous difficulties of the voyage, associated with the poor reception encountered on the new continent, created a less-than-enchanting atmosphere for those venturing to the new lands of this recently discovered world. Basically, only those who had not prospered on European soil could risk their lives. Disease and demise were frequent denominators of the European transatlantic equation. Under conditions clearly not acceptable for most British commoners, in 1603, Henry Keaton became the first surgeon to step into the Virginia territory. During his short visit, surgeon Keaton, unfortunately, succumbed to an Indian attack. As history has taught us, endurance, perseverance, and luck were important components of success. The early settlers frequently faced death, a grim reality in Mr. Keaton's case.[1] Life on this new continent was a continuous struggle between surviving or succumbing to foreign elements.

On May 23, 1607, the vast and fertile lands of North America received the British ship carrying the first permanent settlers to Jamestown, Virginia. The trip was long, difficult, tedious, unhealthy, and dangerous, as would have been expected. Captain John Smith of the London Company brought with him 100 plus passengers, a considerably reduced number from those who had initially embarked on this incredible odyssey. Among the passengers was the second surgeon to arrive in the British American colonies. Thomas Wotton was a gentleman surgeon who risked his life and offered his services during this travesty. Smith praised Wotton for his distinguished services. Wil Wilkison, a barber-surgeon, was also present on this voyage.[1]

Subsequent British ships slowly increased the surgical presence in the continent. In 1608, Anthony Bagnall, in 1610, Lawrence Bohun, and in 1622, John Pott arrived, and they contributed to the attention of patients injured during their daily activities or in the continuous wars with the Indians.[3] The surgeon of the times had few occupational activities except for wound care for trauma and venesection. Attendance on the sick rested in the hands of physicians, who had claimed their position long ago. The surgeon had a very limited repertoire and centuries were to pass before he gained respect and consideration as a medical professional.

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Medical care in the new colonies was highly deficient and improvement was not immediately on the horizon, since few educated doctors wanted to risk their lives on traveling to or dwelling in wild American lands. Oscar Reiss, noted physician historian, summarized this period: "The seventeenth century in the colonies was a period of settlement and movement westward to take more Indian land. Medical care was poor and medical education was worse. The trained physician had invested many years of his life to obtain his degree, and there was no one in the colonies who could pay his fees. Medical care was given by ship surgeons who had jumped ship, barbers, and sometimes by anyone who had a medical book in his possession."[4]

Current practicing surgeons with no historical background would hardly recognize the profession at the time of the colonial settlements. Most of us are probably unaware that our early counterparts were deprived of knowledge, scientific principles, understanding of disease as we currently know it, and that they had little or no experience in surgical matters, except for wound care and setting of fractures. The rest was conjectural supposition. Surgery was brutal, with no anesthesia, antisepsis or experience. As others have suggested, the practice of medicine in colonial America was torture.[5]

Daniel Boorstin, distinguished American historian, unraveled some of the myth around the medicine of the colonies. He recognized that the treatments of North America had the same lack of efficiency as contemporary European treatments. The difference was that North American practitioners interfered less with the patient's recovery and were more in favor of letting nature take its course.[6] Old World medicine relied more on emetics, purgatives, bleeding, and all the cabinet of the heroic medicine. New World medicine was dependent on a more restrained and gentle treatment. Surgery was set at a primitive stage. Surgeons had little to do except for bleeding, wound care, and bone setting. Indian surgery in British America was characterized by a moderate approach, and by attention to religious beliefs, which were generally not aggressive. European surgery, on the contrary, was oriented towards bloodletting, as well as other maneuvers frequently used for wound management and bone treatments.

As the life in the colonies evolved, we do not have a clear account of the functions of the surgeons in colonial society. It is true, however, that at the middle or the end of the seventeenth century, in Britain, surgeons began to exhibit a major interest in stone removal and other operations, such as tumor excision and amputations. In the British colony of Massachusetts, John Clark (1598-1664), a notable surgeon who emigrated from England around 1650, brought with him great experience and exceptional knowledge in bladder stone cutting and other surgeries of the time. Ira Rutkow, recognized surgical historian, introduced a painting of Clark executed by Augustine Clement around 1664.[7] The painting is formidable and is considered to be the first portrayal of a British American surgeon in North America, as well as one of the first to be painted in the English colonies. The portrait hangs at the Countway Library of Medicine in Boston.

The progress of surgery in British America was agonizingly slow, particularly in regard to the exploration of other organs and tissues aside from the musculoskeletal, skin, and tegumentary systems. Surgeons did not recognize theory as part of their approach to medicine or surgery. They were practical individuals with little to no theoretical background. Medical schools did not exist yet in British America and the characterization of the profession was painfully primitive.

The scarcity of physicians and surgeons in the seventeenth century was prominent. Few people came from England, few trained in the British American colonies, and few adopted advanced means of treatment-which in reality did not exist. Virginia, being the first permanent colony (1607), produced the first British American surgeons. Massachusetts was the second colony permanently settled in 1620, and subsequently New Hampshire (1623), New York (1624), Connecticut (1633), Maryland (1634), Rhode Island (1636), Delaware (1638), Pennsylvania (1643), North Carolina (1653), New Jersey (1660), South Carolina (1670), and Georgia (1733) completed the thirteen original colonies. In the same order, their surgeons participated in the incorporation of the rudimentary knowledge of the times. Each colony had its own surgeons, each with different knowledge, each with different treatments, since standardization had not been integrated yet, and each clearly undertook a less-than-desirable therapy.

Eighteenth century British American surgery did not change drastically from the previous century. No great advances had permeated through European medicine and migrated to the New World. Medical developments were more plausible than surgical conquests. The most important source of morbidity and mortality of colonial times was epidemics due to multiple infectious sources. So attention to mitigating fevers was more critical than concentrating on surgical cures. The therapeutic armamentarium was still without full expression. Only Cinchona Peruvian bark—later recognized as quinine—and the introduction of digitalis represented advances during this period. Surgically, the members of the profession began to understand the best ways to use anatomy, in an attempt to improve surgical management. Anesthesia and antisepsis had to wait for the 19th century to find full and effective expression.

The earliest record of medical and surgical apprenticeship in the British colonies is referred to in the first letter of instruction sent to Governor Endicott of the Massachusetts Bay Colony on April 17, 1629. It indicated that Lambert Wilson, a chirurgeon, had been employed to treat the colonists and neighboring Indians for a three year period. In addition, he was to educate and instruct them in his art as much as needed.[8] Chirurgeon Wilson also could be considered perhaps the earliest teacher of anatomy and medicine in the British colonies, followed very closely by Giles Firmin, who came to Massachusetts in 1632.[8]

The first written account of a successful emergency operation in the British American colonies was provided by Increase Mather, pastor of the Second (North) Church of Boston and President of Harvard, who in 1684 wrote in his book, Remarkable Providences Illustrative of the Earlier Days of American Colonisation, about an event that had occurred some 40 years earlier. Two able chirurgeons, Mr. Oliver and Mr. Pratt, were called to operate on Abigail Eliot, then a child, because an iron hinge had pierced her skull and brain. It appeared that a soft matter or the brain (about the size of an egg) had herniated. The surgeons decided to treat this anomaly, with Mr. Oliver making this his operation: "He gently drove the soft matter of the bunch into the wound, and pressed so much out as well as he could. the skull wasted where it was pierced. The child lived to be the mother of two children and she was not by this wound made defective in her memory or understanding."[7]

We can finalize this note by introducing the chirurgeon, Zabdiel Boylston, who first published an account of elective surgery for the removal of a bladder stone in British America in 1710[9] and first inoculated for smallpox—at the persistence of Cotton Mather—in the English colonies in 1721.[8] Furthermore, he should also be considered the first American chirurgeon since he was born in Brookline, Massachusetts, on March 9, 1679, and not on British or European soil.

We hope this work demonstrates the courage and audacity of our surgical ancestors, categorizes some of the hurdles associated with the birth of a discipline, and vigorously orients us towards finding better means of surgical treatment.

References

1. Blanton WS. Medicine in Virginia in the Seventeenth Century. University of Virginia Press, 1930.
2. Rothstein WG. American Physicians in the Nineteenth Century. Baltimore: The Johns Hopkins University Press, 1972.
3. Duffy J. The Healers. A History of American Medicine. Urbana: University of Illinois Press, 1976.
4. Reiss O. Medicine in Colonial America. Lanham: University Press of America, 2000.
5. Terkel SN. Colonial American Medicine. Franklin Watts Inc., 1993.
6. Boorstin DJ. The Americans: The Colonial Experience. New York: Vintage Books, 1958.
7. Rutkow IM. American Surgery. An Illustrated History. Philadelphia: Lippincott-Raven Publ., 1998.
8. Gordon MB. Aesculapius Comes to the Colonies. New York: Argosy-Antiquarian Ltd., 1949.
9. Rutkow IM. Zabdiel Boylston and the earliest published account of an elective, surgical operation in colonial America. Arch Surg 2002; 137:344.

Chapter 39

First American Medical Schools

Luis H. Toledo-Pereyra

America's first English-speaking medical schools were not on the horizon when medical education began to flourish in sixteenth century European cities such as Padua, Leyden, and London.[1,2] Before the advent of English-speaking American medical schools, America's medical practices varied little from those used in Europe. The limited number of educated doctors practicing medicine in America represented the biggest difference between Europe and British America. The first medical school in the thirteen English colonies of America was at the University of Pennsylvania in Philadelphia,[3,4] cradle of civilization in this part of the world. In 1765, when the school began, the city of Philadelphia was reaching out to learn from the great cities of the past. Like many other medical schools around the world, it would be modeled after the best universities of Europe. Although American medicine of English descent generally kept pace with most of the major medical advances in teaching and practice that were happening in Europe, it wasn't until after the University of Michigan medical school had been founded in 1850 and later Johns Hopkins University medical school in 1893, that an American medical school truly represented a well-conceived and organized academic institution that could compete with European counterparts.

The Medical Department of the College of Philadelphia, 1765

There were only two medical schools in the British American colonies before the American Revolution (1775-1789). As indicated before, the first medical school program was the Medical Department of the College of Philadelphia (1765), which today is the School of Medicine of the University of Pennsylvania.[5,7] The second medical school was the Medical Faculty of King's College, New York, which began in 1767 and is now the College of Physicians and Surgeons of Columbia University. The thirst for medical knowledge spread quickly through the most important English-speaking cities of the continent, and several other medical schools were founded.

The city of Philadelphia was at its intellectual prime when the medical school organized its first medical courses. The ardent desire of many of its citizens to excel in the medical field was a dominant force. Beecher and Altschule indicated that Philadelphia was a "fitting place for such a venture, because in 1765 it was the largest town in the North American Colonies."[8] Philadelphia was readily advancing economically and as a seaport and as a merchant area. Furthermore, Philadelphia had already organized the first successful hospital in the colonies, the Pennsylvania Hospital built in 1750 under the stewardship of two Philadelphia heroes, Thomas Bond and Benjamin Franklin.

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Dr. John Morgan (1735-1789) was the founder of the medical school and its first official professor of medicine.[5-7] He graduated from the College of Philadelphia and apprenticed with Dr. John Redman. Redman was a well-respected doctor in Philadelphia who had received his MD at Leyden in 1748. While working with Redman, Morgan served for a year as apothecary in the then-new Pennsylvania Hospital. After the completion of his apprenticeship, Morgan obtained a military medical commission and gained some surgical experience with troops in the campaign of 1759. He spent the following year studying medicine and observing in London hospitals under such men as John Fothergill, William Hewson, and John and William Hunter. In 1761, Morgan entered the University of Edinburgh. It was at Edinburgh that Morgan met an old classmate named William Shippen, Jr. (1736-1808). Morgan and Shippen became friends and discussed a plan to begin teaching medicine at Philadelphia. After his graduation in 1762, Shippen returned to Philadelphia and gave the first formal medical lectures in the English American colonies. Morgan received his degree in 1763 from the University of Edinburgh and traveled to France and Italy where he listened to medical lectures and visited various hospitals. He was elected Fellow of the Colleges of Physicians of Edinburgh and London and of the French Royal Society of Surgery and was made a Fellow of the Royal Society (in London) soon after. During his travels he had developed a plan to introduce a medical college into the American colonies. According to the University Archives and Records Center at the University of Pennsylvania,[6] Morgan used the University of Edinburgh as his model and convinced the university's board to build the medical school within an existing college. It is noteworthy to mention that the early faculty of the medical school earned their medical degrees at the University of Edinburgh and added to their theoretical base with further studies in London. Because the faculty had their hospital experience in London and as they had seen it in that important city, they decided to stress the significance of supplementing medical lectures with bedside teaching at the Pennsylvania Hospital. The first faculty of the school consisted of dedicated and conscientious medical leaders: Morgan, who taught botany and the practice of medicine; William Shippen, who taught anatomy and was also professor of surgery; William Smith, who taught natural and experimental philosophy; and unofficially, Dr. Thomas Bond, who taught clinical medicine. Two years later, Adam Kuhn joined the faculty and was appointed professor of botany and materia medica. The year after that, Benjamin Rush began to teach chemistry.[5-9] The first students of the Medical Department of the College of Philadelphia graduated in 1768, three years after the school had started. The total enrollment in 1768 was about forty students. Between the years of 1768 and 1774 the College of Philadelphia awarded twenty-nine MB degrees and five MDs. During this same time period, King's College awarded only twelve MBs and two MDs. Both schools were granting a limited number of degrees.

Medical Faculty of King's College, New York, 1767

King's College was the second medical school in the British American colonies and the first school to give the degree of MD in English America. Dr. Samuel Clossy, a graduate of Trinity College, Dublin, began giving lectures in anatomy in 1763 at King's College before the medical school was founded. Four years later, Clossy and five other distinguished physician leaders (John and Samuel Bard, Peter Middleton, James Smith, and John Jones) proposed creating a medical school modeled after the universities of Great Britain within the already existing King's College.[10,11] In 1767, 39 the Board of the college approved the plans to establish a medical school, in close resemblance of what had happened in Philadelphia.[5-11] In this case, different than the medical school in Philadelphia, King's college was not as much interested in "physic" as it was in surgery. When the school opened, Samuel Clossy served as professor of anatomy, Peter Middleton as professor of physiology and pathology, James Smith as professor of chemistry and materia medica, Samuel Bard as professor of the theory and practice of physic, John Jones as professor of surgery, and John V. B. Tennent as professor of midwifery.[10,11]

David C. Humphrey's *From King's College to Columbia 1746-1800*[11] mentions that "professionals" such as Middleton, Clossy, and Bard looked down upon "empirics" and structured the school's curriculum around their belief that professionals should be taught to be scientific and ethical. They admired the "rational physician" who "organized his medical knowledge into theories which explained the functioning of the body and the cause and treatment of disease" and instead of using a previous treatment or trial and error for unusual sickness, he "applies the ideas he had already formed in his mind, about the nature of diseases in general, to this particular case; by which he easily discerns the genius of the disease; whence it arises; the true indications of cure; and what method ought chiefly to be pursued."[11]

A History of Columbia University 1754-1904 indicates that the first baccalaureate degrees went to Robert Tucker and Samuel Kissam in 1769.[10] The same individuals earned the first doctorates in 1770 and 1771. Nine other people received their baccalaureate degree by 1774, and thereafter the degree was terminated.[10]

Medical School of Harvard College, 1782

The Medical School of Harvard College began considering students for admission in 1782.[8,12] According to Beecher and Altschule in their book *Medicine at Harvard: The First Three Hundred Years*, the proposal for a school was first made at the meeting of the Boston Medical Society of November 30, 1781. It occurred when someone asked Dr. John Warren (1753-1815), reputable physician surgeon of the time, to repeat a course of anatomical lectures similar to those he had given the previous year at the military hospital. Warren suggested that since there seemed to be an adequate number of students wanting to attend lectures, a medical school should be established. Coincidentally, at the same time, Harvard University began to think seriously about setting up its own medical school. A committee was set up to discuss the matter and responded favorably. The committee described the establishment of professorships of physic at the University. Professors were to be elected and confirmed by overseers.[8,12]

Harvard had three professors as its initial faculty, all of them prominent and respectful physicians. The first was John Warren. He was appointed the first professor of anatomy and surgery on November 22, 1782. He felt that "the greatest needs were for systematic instruction and clinical experience." Shortly thereafter, Benjamin Waterhouse of Newport, Rhode Island, was appointed Professor of the Theory and Practice of Physic, and Aaron Dexter was named Professor of Chemistry and Materia Medica.[8,12]

The Medical Institution of Harvard University was officially established on October 7, 1783. Similar to the two previous medical schools, the Harvard school was modeled after the University of Edinburgh; its initial surgical practices were especially influenced by this connection. Medical students at Harvard would attend formal lectures for a semester or two, and then they were apprenticed to a practicing physician for several years. They weren't required to have any academic preparation prior to coming to Harvard nor were they required to take written exams. The school's first students bought tickets for lectures instead of paying tuition. Harvard did not have a hospital, and as a result, medical students weren't required to have clinical training. As the medical school matured, it would establish a cordial and strong medical association with the hospitals of the community. In this situation, the Massachusetts General Hospital would be a perfect example.

Medical Department of Dartmouth, 1797

The creation of Dartmouth was completely different than the previous three medical schools. The faculty was represented by only one man: Dr. Nathan Smith (1762-1828).[13] There was no added faculty and thus Smith did not have anyone else with whom he could discuss plans for the formation of the new medical school. He would have to organize and cover all the possible lectures by himself, not an easy task to undertake then or today.

Nathan Smith wrote a letter to the Board of Trustees at Dartmouth on August 25, 1796, in which he proposed that a medical school be founded at Dartmouth College. In that same letter, he also told them that if they would establish a medical school and give him an appointment, he would study the medical practices of Edinburgh and London and bring that knowledge back with him to teach Dartmouth medical students. Smith went to Edinburgh for three months and then went on to London where he also spent three months, researching the practices in the Edinburgh and London hospitals and schools. Shortly after his return, Dartmouth Medical School opened in 1797, still without board sanction. Nathan Smith, who is considered the founder of Dartmouth's medical school, was the first to give medical lectures in 1797. It wasn't until 1798 that the board of trustees set up a one-man professorship in chemistry and materia medica, anatomy and surgery, and the theory and practice of physic. That same year, the school also established a curriculum which closely followed that of Harvard. Nathan Smith taught everything virtually alone until 1808 when he invited Alexander Ramsay to lecture on anatomy. Sadly, Ramsay only lasted through one course of lectures at the school. Nathan Smith went on teaching alone after that, always keeping up with newest medical advances, and the medical institution continued to prosper. Smith did a good deal of teaching at the bedside and often took students with him to see patients. It wasn't until 1810 that the school hired another professor, Cyrus Perkins, to be Chair of Anatomy and to take up some of Smith's duties. In 1812, Smith worked out the requirements for the school to have an MD degree instead of an MB. In 1813, Nathan Smith left the school he had founded to get a new one established: Yale Medical School.

In summary, since the first American medical school opened in 1765, American medicine and medical teaching practices have followed some of the European models. Leyden, London, and Edinburgh were prominent examples of European descent that were fresh in the minds of English American medical schools. On this continent, Pennsylvania, Columbia, Harvard, and Dartmouth presented themselves as the heirs of American medical genesis. Other schools in the mid-nineteenth century such as the University of Michigan founded medical departments to prepare medical students to a better way of medical practice. With the advent of schools based more in the German system such as Johns Hopkins University and the introduction of dedicated and full-time faculty physicians, America started on its own unique and distinguished path in the history of the world's best medical schools.

References

1. Castiglioni A. A History of Medicine. 2nd ed. Translated by Krumbhaar EB. New York: Alfred A Knopf, 1947.
2. Singer C, Underwood AE. A Short History of Medicine. London: Oxford University Press, 1962.
3. Rothstein WG. American Medical Schools and the Practice of Medicine. A History New York: Oxford University Press, 1987.
4. Luft E. The Earliest North American Medical Schools. Chronological List of Founding Dates State University of New York: Upstate Medical University Health Sciences Library, 2003 Available at: http://www.upstate.edu/library/history/medschoolfoundingdates.html
5. Corner GW. Two Centuries of Medicine. A History of the School of Medicine. University of Pennsylvania: Philadelphia: JB Lippincott Company, 1965.
6. History of the School of Medicine. University Archives and Records Center, University of Pennsylvania Available at: http://www.archives.upenn.edu/histy/schools/med.html
7. Cheyney EP. History of the University of Pennsylvania. Philadelphia: University of Philadelphia Press, 1940:1740-1940.
8. Beecher HK, Altschule MD. Medicine at Harvard: The First Three Hundred Years. New England: Hanover, New Hampshire University Press, 1977.
9. Duffy J. From Humors to Medical Science. A History of American Medicine. 2nd ed. Urbana: University of Illinois Press, 1993.
10. A History of Columbia University. New York: Columbia University Press, 1904:1754-1904.
11. Humphrey DC. From King's College to Columbia. New York: Columbia University Press, 1976:1746-1800.
12. HMS History Available at: www.hms.harvard.edu/about/history.html
13. Chapman CB. Dartmouth Medical School. The First 175 Years. New England: Hanover University Press, 1973.

Chapter 40

Military Surgery

Melissa Chen

War in the 19th century demonstrated a capacity for death and destruction more horrific than ever seen before. Crowded camps, poor sanitation, and inadequate nutrition exacerbated the mortality rates already skyrocketing from a more lethal weaponry. The battlefields urgently required surgeons and in exchange provided an endless array of injuries on which the inexperienced could perfect the surgical arts. The 18th century barber-surgeon was transformed into a polished performer of complex operations, first an innovator on the battlefield and then a teacher in civilian hospitals.

The great painting realized by Marguerite Delorme (1876-1946) in 1897, *"Le Professeur Delorme..."*, currently maintained at the Val-de-Grace Museum in Paris, clearly illustrates this metamorphosis. Professor Edmond Delorme (1847-1929), a French military surgeon, demonstrates a new surgical method (pulmonary decortication) to a group of medical students in the Val-de-Grace Hospital of Paris. Where military surgery was once performed out in the open, on the ground, and with such great haste that cleanliness was no concern, we now observe a radically transformed scene. The students are clad in white gowns and clustered around an operating table within an enclosed room. The sink in the foreground and bowls on the floor suggest that attention was given to washing of the hands and of the wounds; perhaps the bowls contained carbolic acid, whose antiseptic properties were introduced in the operating room by Joseph Lister in 1865. The pot in the window suggests the sterilization of dressings, which also was pioneered by Lister, an English military surgeon.

The 19th century witnessed great changes in the nature of surgery. At the beginning of the period without anesthesia, surgeons were prized chiefly for their swiftness; one famous surgeon, Sir Robert Liston, reportedly could amputate a leg in 28 seconds. With anesthesia, operations could be performed with greater delicacy and precision. Advances in bacteriology allowed military medicine to break the dominance of infection and infectious diseases as the primary causes of death on the field. More attention could be focused on the actual surgical procedures that were practiced on the front lines.

Governments were motivated to support a grander scale of medical facilities than ever before, if not for humanitarian reasons then for economic ones. In this age of high mortality rates, manpower was expensive. Thus emerges the paradox of medicine in war: The primary goal is not to preserve health for the sake of the individual, but for the sake of destroying the enemy.

Regardless, a method had to be created to address the mass casualties that could not be treated by the medical system of the 18th century. There was no way of

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

removing the wounded from the front, much less a method of moving the wounded into interior hospitals. The medical supply storehouses were too distant to mobilize supplies quickly, but they were depleted anyway within a few weeks of war. Hundreds of thousands of soldiers fell ill with diseases such as smallpox and yellow fever.

Dominique-Jean Larrey, Napoleon's medical director and chief surgeon, demonstrated in 1792 that evacuating the wounded could save valuable manpower. His designs of two- and four-wheeled ambulances were the first the West had seen since Roman times and became standard in most major towns in the West by the end of the 19th century. Pierre Percy, another military surgeon, designed litters out of lances a few years later. A similar kind of chair for transporting the wounded is illustrated in the shadowy foreground of the cover art.

The experience of large numbers of surgeons stimulated innovations in other surgical procedures. Larrey developed the semicircular needle with a lancet-shaped cutting point. The Hodgen splint, still used today for femur fractures, was introduced in 1863 by Civil War surgeon John Hodgen. Plastic surgery emerged in the Civil War with the first total facial reconstruction in history, performed by Dr. Gordon Buck, a contract surgeon for the Union Army. Such techniques, learned and mastered by thousands of surgeons through hard experience, were carried back to civilian life, thereby elevating the general level of medical care available to the world.

Other military innovations of the 19th century became the forerunners of modern medical administration. The Civil War brought the first accurate and comprehensive medical record system, which made it possible to track casualty records for every soldier. The Red Cross was created by the 1864 Geneva Convention for the treatment of the wounded, and all medical personnel were granted neutral status.

It is interesting to note the pervasiveness of the military not only in the early stages of surgery but also in civilian life. Beginning in the mid-Victorian era, war became the business of the whole of society. As the frequent and devastating wars commanded our energy and resources, they also invaded our way of thinking about ourselves and, by extension, the procedures that affect us. We see this militarization in our medical vocabulary, which is dominated by warlike metaphors: The battle against disease often enlists the aid of magic bullets (which often arrive in the form of shots). Our defense systems struggle to fight off invading bacteria, which could colonize a vulnerable host. We wage war on heart disease and do our best to ward off the cancer that infiltrates the target cells.

References

1. Larrey DJ. Memoirs of Military Surgery and Campaigns of the French Armies. Hall RW, translator. Baltimore: J. Cushing, 1814.
2. Da Costa JC. Baron Larrey. Bull Johns Hopkins Hosp 1906; 17:195-215.
3. Bollet AJ. Civil War Medicine. Challenges and Triumphs. Tucson: Galen Press, 2002.

Chapter 41

American Civil War

Luis H. Toledo-Pereyra and Alexander Horacio Toledo

The American Civil War was a gruesome and horrendous spectacle. While virtuous and inevitable on a philosophical plane, it was universally devastating to the generation of Americans caught in this painful struggle. For four years, more than one million Americans sustained a continuous fight against each other.[1-8] The nation was divided into North and South, Union and Confederate, Federalist and NonFederalist. It was a war fought amongst brothers, friends and neighbors. Amidst this chaos, American medicine was presented new challenges in wound and trauma management, care of the injured, and transportation for the sick. It was a large and comprehensive laboratory of patients and maladies that the American physician/surgeon was often ill-prepared to handle. Overwhelmed by overcrowding, infectious disease, limited supplies and the sheer volume of traumatic injuries, Civil War surgeons reported high mortality rates throughout this conflict.[1-26]

This writing briefly reviews the medical history of the Civil War, from the medical statistics accumulated to the care of the injured and diseased soldiers. It also addresses the impact of the war on the practice of medicine, and the contributions made during this era.

Medical Statistics

The Civil War took more American lives than any other war in the history of the country. The total number of deaths in the war was 624,571, of which 364,511 belonged to the Union and 260,000 to the Confederacy. Until the Vietnam War, the fatal casualties observed in all other American wars combined were not as extensive as the ones seen in the Civil War.[1-4,7] The magnitude of this event in the history of the nation cannot be overstated. Death ran rampant in the fields of this divided war. The time in which the Civil War occurred in the history of medicine did not allow for the availability of advanced and sophisticated treatments in the management of regular diseases or battlefield injuries.[1-4]

Among the different causes of death during the Civil War, persistent fevers, intestinal diseases, and pulmonary diseases were frequently observed. Confederates had a higher percentage of the above causes, while the Union Army had a higher proportion of deaths due to combat or battlefield-related injuries.[1,3,7]

Care of the Injured and Diseased Soldiers

The number of physicians available at the start of the war was incredibly low, and those who served were ill-prepared to care for the unexpectedly high number of injured and diseased soldiers. No curriculum or institutions could adequately train the medical staff for this undesirable event. The Union Army medical staff consisted

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

of a surgeon general, thirty surgeons, and eighty-three assistant surgeons when the war began. Of these men, twenty-four resigned to help the Confederacy, and three other assistant surgeons were declared disloyal. Given these elements, it is not surprising that this war would carry such a disproportionately high mortality and morbidity throughout its initial battles.

The Confederate Army medical staff was equally as ineffective as the Union side. In fact, because it needed to be created from the beginning, it was less organized and equipped than the Union counterpart. The Confederates depended on the will of the state governors to recruit the surgeons and assistant surgeons needed for the care of the injured and diseased soldiers.

The sanitary conditions in the battlefield, in the operating theater, and in the temporary field hospitals were dismal. Surgeons operated in dirty coats, well-developed antiseptic procedures were not utilized, surgeons wore no hats, masks, or gloves, and instruments and dressings were not consistently cleaned. Surgeons and staff had no regard for the germ theory of disease at this point in time. The findings of Semmelweis on the use of antiseptic techniques such as the use of lime chloride to rinse the physicians' hands prior to obstetrical delivery had not been instituted. The antiseptic techniques according to Lister had not yet been published. This would not happen until 1867, two years after the Civil War had finished.

Surgeons were eager to operate in the first twenty-four hours before infection would set in. Most commonly, the "dreadful" minnie ball was the responsible ammunition during the Civil War. These bullets were extraordinarily damaging on impact and shattered any bone with which they came in contact.[1-4,7] Most of the surgeries were located in the extremities. Other sites such as the head, neck, chest, and abdomen had a bad prognosis with high mortality. The most common operation was an amputation, either of the flap or circular type. At war's end, barely fifty percent of surgeons preferred the flap operation. Experienced surgeons could amputate a limb in less than ten minutes. In this hectic and depleted venue, soldiers with slight wounds, as well as those who were mortally wounded, caused no impression on the pragmatic surgeons who dedicated themselves to those wounded soldiers with a plausible chance of remaining alive. Surgeons had to make quick and brutal decisions based on prognosis and possibility of success. These were the days of Civil War medicine!

In general, traumatic injuries received attention whenever possible, and mortality was more frequently encountered due to sickness and disease than from battle injuries in a two-to-one relationship. It was not infrequent that four or five days after surgery, patients would develop surgical fevers, for which there was no specific treatment. Their presence carried a high mortality, around 90% for pyemia, or pus in the blood. The cause of these fevers was infectious and most likely of the *Streptococcus pyogenes* or *Staphylococcus aureus* variety. Antibiotics were not available and would not appear until three quarters of a century later. Several disinfectants were available such as iodine, carbolic acid, bichloride of mercury, sodium hypochlorite, and other agents. These agents were only used for the treatment of wounds with severe evidence of infection. Disinfectants were not routinely utilized to prevent wound infections. The relationship between germs and wound infection was not recognized by the great majority of American surgeons of the time. The acceptance of the germ theory of disease would be a pivotal event in reducing the bacterial load in these wounds.

A detailed description of the manner in which the surgeon took care of his battlefield cases can be encountered at www.USCivilWar.Net:

> *The field hospital was hell on earth. The surgeon would stand over the operating table for hours without a let up. Men screamed in delirium, calling for loved ones, while others lay pale and quiet with the effect of shock. Only the division's best surgeons did the operating and they were called 'operators.' The surgeon would wash out the wound with a cloth (in the Southern Army sponges were long exhausted) and probe the wound with his finger (the finger being usually used), or a probe perhaps, looking for bits of cloth, bone, or the bullet. If the bone was broken or a major blood vessel torn, he would often decide on amputation. Later in the War, surgeons would sometimes experiment with resection, but far more common was amputation.*

Anesthesia was almost universally utilized in all surgical procedures. Chloroform was the favored anesthetic, used 75% of the time through the open drop technique, with a 0.4% mortality. Ether did not have a high level of repute in combat settings because of the possibility of explosion due to its flammability. In addition to the anesthetic agent, patients would receive various doses of whiskey, opiates, and possibly quinine. All these substances were complementary to the regular anesthetic administered.

From the words of a student of Civil War affairs,[7] we can summarize the actual operative procedure during the Civil War in the following manner:

> *The surgeon usually had an operating table of a couple of boards between barrels. He usually had a rag soaked with chloroform, which was liberally doused…Somehow, surgeons knew enough to periodically remove the rag or sponge. Therefore, few deaths resulted from chloroform poisoning. It is generally a myth that most operations were performed without anesthesia, with only a bullet to bite. Surgeons usually used the following procedure. First the surgeon would cut off the blood flow with a tourniquet. After that he would take a scalpel and slice through the outlying tissue and flesh. Then he would use a hacksaw-like tool called a capital saw to saw through the bone. It had replaceable blades. After the bone and flesh was sliced off, the surgeon would take silk sutures in the North and cotton sutures in the South, and sew the major arteries and veins together. The limb would be dropped on a pile that got thrown out after the day. Time was of the essence, so the soldier would be carried off of the platform and another soldier would be placed on the platform. This would take about fifteen minutes.*

Patient care after the operative procedure was rudimentary. Hospitals were not all well supplied and personnel had no consistent techniques to follow. The care relied on the hands of assistant surgeons, nurses, and other medical personnel. At the time of the Civil War, there was no intravenous fluid administration, laboratory tests, or radiological studies. It would take decades before these therapeutic and diagnostic modalities would be available.

During the American Civil War, the nation was so fully consumed with this horrific struggle that few resources, financial or intellectual, were available to nurture any significant scientific development in American medicine. For the Civil War physician, there was no time to investigate curiosities, nor the financial or material support to initiate such work. However, while American medicine was not to be prepared to make great strides scientifically in this chaotic environment, many other contributions were molding American medicine.[1-18] The development of the Sanitation Committee and hospital system, the contribution of women to the medical system, and improvements in treating traumatic injuries were all accomplished during the Civil War.

Competency of Medical Practitioners

It was said by more than one surgeon that the Civil War was being enacted "at the end of the medical Middle Ages" (Hunter McGuire, confederate surgeon). Despite their heroic and persistent efforts, physicians had practically no knowledge behind their treatments used during the Civil War. Science, technology, and medical care had not reached acceptable levels, and "surgical techniques ranged from the barbaric to the barely competent." Fallen soldiers, Union or Confederate, could expect poor care by unprepared medical corps.

The education of doctors during this period was clearly insufficient to address all of the disease and injury flowing from the battlefield. Most physicians served as apprentices instead of having formal training. Even those who attended medical school received poor training. In the United States, students of medicine spent less than two years in the classroom, and no clinical experience or laboratory instruction was provided. It was frequently said that Harvard Medical School "did not own a single stethoscope or microscope until after the war." The training of other medical professionals such as assistant surgeons, nurses, and volunteers was similarly meager, disorganized or nonexistent. Significant lessons were to be learned as the war progressed.

Compounding these educational inadequacies exposed by the war, the supply and efficacy of medications during the Civil War was also unreliable. The medicines utilized during the Civil War times included a large number of natural medicines. Often these recommendations could vary widely between different physicians or pharmacists. Common remedies at this time included:

> *For rash they used red-oak bark and alum. Goose grease and sorghum, or honey, was a standard remedy for croup, backed up with turpentine and brown sugar. Sassafras tea was given in the spring and fall as a blood medicine. Adults' colds were doctored with horsemint tea and tea from the roots of broom sedge. For eruptions and impure blood, spice-wood tea was given. Wine was made from the berries of the elder bush. For diarrhoea, roots of blackberry and blackberry cordial; and so, also, was a tea made from the leaves of the rose geranium. Mutton suet, sweet gum and the buds of the balm of Gilead was a standard salve for all cuts and sores. Balsam cucumber was widely used as a tonic, and was considered a specific remedy in burns. Catnip, elecampane, and comfrey root and pennyroyal were in every good housewife's pantry, in which, also, was the indispensable string or red peppers, a bag of sage leaves and of 'balm.' Calamus root for colic in babies was a common dose. The best known standard Georgia tonic was dogwood, poplar and wild cherry barks, equal proportions, chipped fine and put in whiskey and taken wineglassfull at meal times; it is still used in large quantities from 'Yamacraw to Nickajack.' Dogwood, sumac and the roots of pine trees were largely used, and indigo was cultivated in the gardens. Instead of paregoric, fennel-seed tea was given to the babies. In hemorrhages, black haw root was commonly used. All the white mustard we had was raised in our gardens.*[7]

During the war, druggists and physicians were forced to prescribe medicine substitutes for imported products that were cost prohibitive or unobtainable. Often these scarce remedies were not available at the time or location required. Although the use of substitute medicines had little effect on the quality of health care, it reflects the dearth of medical supplies and resources, as well as the ingenuity of Civil War clinicians.

As thousands of doctors, nurses, and volunteers served in this national nightmare, medical care and techniques slowly improved. Some of these advances filtered down from the high echelons of the medical departments of the Union and Confederate military. In general, these leaders were both competent physicians and administrators. Some notable individuals were Dr. Samuel Preston Moore, Surgeon General of the Confederacy, and Dr. Samuel Stout, Superintendent of the Department of Tennessee. In the Union, Dr. William Hammond served as Surgeon General and other significant contributors included Drs. Letterman, Smart, Woodward, Huntington, and Otis. However, it was often the cumulative battlefield experience of the rank and file clinicians that drove progress.

Medical Advances during the Civil War

Amidst the tragic stream of casualties, injuries and infections, Civil War physicians were handed an incredible opportunity. Surgeons learned how to deal with all kinds of "ghastly wounds" and complicated injuries of the head, chest, abdomen and vascular system. They learned how to more effectively ligate arteries in difficult lesions of the lower and upper extremities. Additionally, surgeons were forced to learn the most effective means of performing amputations. Amputations of all kinds, settings and circumstances were undertaken.

During this time, surgeons also made significant advances in more delicate procedures. Improvements in addressing facial injuries and wound reconstruction were aided by the development of detailed plastic surgery techniques. Complex facial trauma challenged surgeons to provide innovative means of closure. It was behind the battlelines that American surgeons learned the early secrets of reconstructive surgery. While heralding these advances, it should be remembered that only in the climate of adequate analgesia were these accomplishments possible. As was mentioned before,[26] anesthesia was performed with excellent results and minimal morbidity and mortality. Common agents included chloroform and ether. However, in spite of these focused advances reached during the Civil War, surgical knowledge was limited and physicians were still frequently overwhelmed by disease and infection. This state persisted until at least the 1880s when the germ theory and aseptic principles helped establish a modern surgical foundation.

Transforming the American Medical System

With American medicine largely stagnated as it awaited scientific and technological contributions, both the Union and Confederacy aimed to expedite and optimize health care delivery. The initiation of the Sanitation Committee, and the advancement of the hospital system and nursing profession were some of the highlights of this era.

The United States Sanitary Commission was one of the great developments of the Civil War. This body illustrated the importance of having a complementary group that "was to do what the government could not do." The Sanitary Commission grew from the invaluable complementary support that women provided in improving the care of soldiers. In spite of strong opposition from the War Department, President Lincoln, and the medical corps, the Sanitary Commission was finally enacted on June 13, 1861, with the following purposes:

> *To inquire into the recruiting service in the various States and by advice to bring them to a common standard; second, to inquire into the subjects of diet, clothing, cooks, camping grounds, in fact everything connected with the prevention of disease among volunteer soldiers not accustomed to the rigid regulations of regular troops; and third, to discover methods by which private and unofficial interest and money might supplement the appropriations of the Government.*

The United States Sanitary Commission, much like how the British Sanitary Commission had helped in the Crimean War, aided with functions that the government could not do. The Americans were organized under the leadership of two reformers, Dr. Elisha Harris, a noted public health figure, and the Reverend Henry Bellows, a distinguished Unitarian minister. Frederick Law Olmsted, the outstanding New York architect, was selected by Bellows to serve as the secretary of the commission. However, in reality, the strength of this organization came from thousands of dedicated women, who built a network that would duplicate and surpass the work of Florence Nightingale and her associates in the Crimean War.

The commission actively participated during all phases of the Civil War. They sought, secured, and brought needed supplies to the soldiers. They improved nutrition and enhanced the sanitary conditions of the Union Army. The South did not have this level of support or organization. Their inferior supplies, nutrition, and condition became more apparent and relevant as the war progressed. The principle of universality of relief established by the commission never came to fruition for the Confederacy; the South, without any central organization, had to rely on local women's aid societies.

The commission organized branches in various Northern cities. These branches facilitated the distribution of care and supplies to as many soldiers as possible. Throughout its involvement during the Civil War, the indefatigable commitment of this vital and generous group accounted for nearly twenty million dollars in money and supplies.

While the Sanitation Committee disbanded at the end of the war, many other contributions to the American medical system persisted. Medical transportation, in the form of an ambulance system, was taken to the highest level of efficiency during this time period. Mobilization of the sick, development of provisional hospitals, particularly the pavilion type, and improvement in embalming of dead soldiers were all advances seen during the Civil War. By the end of the war, 204 Union general hospitals had been built with beds for 136,894 patients.

"Angels of the Battlefield"

Beyond their role in securing nutrition and supplies via the Sanitation Committee, women also served as battlefield nurses. Nearly two thousand dedicated and unselfish women from both sides of the fight volunteered as nurses in the hospitals of the Civil War. At age 59, Dorothy Dix (1802-1887) enlisted her services to the Union army, and in June 1861, she became the Union's Superintendent of Female Nurses. In this capacity, she organized an unparalleled group of volunteer Union nurses. She selected women who could perform the job effectively and who would be "plain looking and middle aged." Dix was stern, autocratic, self-reliant and highly committed to both the nurses and soldiers' cause. She was an important contributor to the Union's goals, and at war's end, she returned to her civilian work on behalf of the mentally ill.

Another esteemed leader in organizing nurses during the Civil War was Clara Barton (1821-1912). Originally from Oxford, Massachusetts, she was working for the U.S. Patent Office outside of Washington, D.C. when she heard of the injury and suffering at the Battle of First Bull Run (Manassas) in July 1861. Shocked by the suffering and poor conditions, she joined the Union and organized an independent group to distribute medical supplies. Officially, she served as Superintendent of Nurses in Major General Benjamin Butler's command, in addition to her nursing work at Virginia and South Carolina military hospitals. After the war, she continued her relief work, contributing to the founding of the American Red Cross in 1881. Barton and Dix were radiant pillars of the nursing movement to improve medical care during the Civil War.

On the Confederate side, we encounter some notable nurses, as well. Sally Tompkins, Kate Cumming, Phoebe Pember, and Ella Newsom, were among the Southern women recognized as leaders in the Confederacy ranks. They all actively participated in the caring for the sick and wounded, and like so many women of this era, also worked to secure supplies for medical use. In addition, these nurses organized funding events and assisted in planning medical strategy within the Confederacy.

Conclusion

In many of these bloody battles between the Union and Confederacy, no clear winner emerged. By attrition and painstaking perseverance, the Union forces eventually prevailed. Likewise, American medicine, scantily armed with science and supplies, struggled through this devastating event. In this era before sanitation, hygiene, and the germ theory of the disease were fully incorporated into routine clinical practice, surgeons discovered the best way to use anesthesia, perform amputations, ligate arteries, operate in the vascular system, and work on facial injuries. Mobilization of the sick and medical transportation were considerably improved. Hospital design gained in experience and recognition. Embalming of the dead also attained higher standards.

In addition to these accomplishments in adverse conditions, Civil War medicine must also be remembered for the unsung contribution of the thousands of women who toiled in anonymity during the war. From patient care to fundraising to securing medical supplies, their work was essential in coordinating patient care. These efforts blended into the larger network of hospitals, ambulances, clinics, doctors, nurses and volunteers that laid the foundation of our medical system.

Overseeing this evolution of American medicine and health care were the great personalities of this time such as Hammond and Letterman from the Union, Moore and Stout from the Confederacy, Bellows and Olmsted from the Sanitary Commission and nurses Dix and Barton. Their leadership helped provide and organize the infrastructure of American medicine, while battlefield surgeons and clinicians earned medical achievement in a slow and deliberate manner that mirrored this gruesome yet progressive war.

References

1. Adams GW. Doctors in Blue. The Medical History of the Union Army in The Civil War. New York: Henry Shuman, 1952.
2. Beller SP. Medical Practices in the Civil War. Cincinnati: Betterway Books, 1992.
3. Wilbur CK. Civil War Medicine. Old Saybrook: The Globe Pequot Press, 1998.
4. Bollett AJ. All those Amputations. Resident and Staff Physician 1999; 45:83-85.
5. Cassedy JH. Medicine in America. A Short History. Baltimore: The Johns Hopkins University Press, 1991.
6. Catton B. The American Heritage Picture History of the Civil War. New York: American Heritage Publishing Co., 1960.
7. Civil War Medicine Available at www.eHistory.com
8. Dammann G. Pictorial Encyclopedia of Civil War Medical Instruments and Equipment. Missoula: Pictorial Histories Publishing Company, 1983.
9. Ashburn PMA. A History of the Medical Department of the United States Army. Boston: Houghton Mifflin, 1929.
10. Denny RE. Civil War Medicine: Care and Comfort of the Wounded. New York: Sterling, 1994.
11. Bollett AJ. Civil War Medicine. Challenges and Triumphs. Tucson: Galen Press, 2002.
12. Duffy J. The Healers: The Rise of the Medical Establishment. New York: McGraw-Hill, 1976.
13. Cassedy JH. Medicine in America. A Short History. Baltimore: Johns Hopkins University Press, 1991.
14. Cunningham HH. Doctors in Gray. Baton Rouge: Louisiana State University Press, 1993.
15. Smith GW. Medicines for the Union Army. New York: The Haworth Press, 2001.
16. Truesdale J. The Blue Coats and How They Lived, Fought and Died for the Union. Philadelphia: Jones Brothers, 1867.
17. Freemon FR. Gangrene and Glory. Medical Care During the American Civil War. Cranbury: Fairleigh Dickinson University Press, 1998.
18. Holt DM. A Surgeon's Civil War. The Letters and Diary of Daniel M. Holt, M.D. Kent: Kent State University Press, 1994.
19. McPherson J. Battle Cry of Freedom. The Civil War Era. Oxford: Oxford University Press, 1988.
20. National Museum of Civil War Medicine. Available at: www.civilwarmed.org
21. Pember PY. A Southern Woman's Story. Life in Confederate Richmond. Jackson: Bell Irvin Wiley, 1959.
22. Schroeder-Lein GR. Confederate Hospitals on the Move: Samuel H. Stout and the Army of Tennessee. Columbia: University of South Carolina Press, 1994.
23. Shultz SM, Casady RL, Hoffman RR et al. The Last Confederate casualty at Gettysburg: A case report and review of similar historic cases. J Am Coll Surg 2000; 191:204-207.
24. The History Place. Available at: www.historyplace.com 2003.
25. The Sanitary Commission & Other Relief Agencies. Available at: www.civilwarhome.com 2003.
26. Toledo-Pereyra LH, Toledo AH. American Civil War. Part I. J Invest Surg 2004; 17:3.

Section VI. Short Editorial Notes: Philosophy and Humanities

Chapter 42

The Soul of the Knife

Luis H. Toledo-Pereyra

Why is it so important to describe the soul of an instrument? Because we believe that it clearly represents the essence, the being of the surgical profession. Why do we believe that it would carry a significant burden in the formation and life of a surgeon? Again, because we believe that it teaches to the young and the mature surgeon all the knowledge and experience that it has amassed in millennia of practice and existence. Because it brings with it the commitment and determination of all dedicated professions. Let us then describe the instrument, some of its contributions, and its brief history.

The knife, as primitive as it might appear, embodies the essence of life and death. These contradictory possibilities are evoked by the sole presence of the steel instrument. If the knife could speak, it would tell stories of surgeons past: how they practiced, what they knew, and, most importantly, how they treated their patients. The knife would narrate stories of its elevation as well as its degradation in the hands of practitioners.

The primitive surgeon used flint, quartz, shells, beaks of birds, and whatever sharp objects were readily available.[1] Egyptians, Sumerians, Greeks, Hindus, Romans, Arabs, and other Europeans utilized the knife or sharp instruments to treat their patients surgically. Writers of the period did not customarily acknowledge the knife. Hippocrates and his school first used the *macairion* (a swordlike knife) to open up wounds and conduct surgeries.[1] Galen, as surgeon to the gladiators in Rome, relied on a large number of cutting instruments. Surgeons in Pompeii, Italy, developed 13 different knives for surgery. During the Middle Ages, the knife sat unused, only to be rediscovered during the Renaissance. Mondeville, de Chauliac, Arderne and Vesalius excelled in using the knife, as demonstrated by the amazingly detailed drawings of *DeHumani Corporis Fabrica* (1543).[2] What an extraordinary achievement in anatomy and surgery! Years would pass before the knife would be employed routinely by professionals of the surgical trade.

Expressions of the knife were as individual as the surgeons who wielded them, sometimes tenderly, sometimes roughly, usually in an attempt to offer the best for an ailing patient. Generations of surgeons learned how to maximize the utility of the august yet common knife. As we train new surgeons, we can also introduce respect and understanding for this rudimentary but distinguished companion of the operative act. Surgical training enhances the characterization of the soul and essence of the knife, as well as encourages its correct use and universal application.

The soul of the knife resides in the symbiotic combination of *instrument-surgeon-patient*. The interplay of these three illuminates the soul of the knife, the essence of the instrument. Only in this triad can the expression of the knife find consummation.

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

The knife is the supreme actor in the operating theater; without it there would be no operation, no active stage, no drama. The knife is the main protagonist. All other instruments, including clamps, pickups, scissors, and needle holders, respond directly to the knife's actions. Held in the surgeon's hand and incising the patient's skin activates the soul of the knife. Suddenly the knife has life, a role to play, a function to fulfill. The completion of the operative act reaffirms the soul of the knife.

From the first half of the 16th century to the mid-19th century, the knife flourished in the hands of surgeon-anatomists: Pare, Cowper, Sanctorius, Petit, Desault, Scarpa, Heister, Cheselden, Pott, the Hunters, Bell, Abernethy, Cooper, and Syme. In North America, the soul of the knife was vibrant in the works of Physick, Shippen, Warren, Mc Dowell, Beaumont, and Sims. The introduction of anesthesia (1846) and antisepsis (1867) vastly changed the contributions of the knife.With Lister's innovations, modern surgery arrived. Organ and system specialization became a reality. The knife was here to stay! Long hours of dedicated work were about to be compensated.

In recent decades, the knife has been modified. We now have energy knives, electrical knives, the laser knife and the gamma knife. Each evolutionary improvement reaches higher heights. Some believe that a more appropriate term for the surgical knife would be scalpel (from the Latin *scallpellus*, used by the Romans).[1] I subscribe to the more general term. And I continue to search for better ways to grasp, appreciate, and teach the soul of the surgical knife. An example of the reverence that this instrument produces in many people is reflected in Richard Selzer's *Mortal Lessons*: "Even now, after so many times, I still marvel at its power—cold, gleaming, silent. More, I am still struck with a kind of dread that it is I in whose hand the blade travels".[3] It is at this moment that respect for the knife creates the spirit of its soul. The knife is transformed as the knife and surgeon become one and inseparable, ready to perform wonders for the patient's well being. Now, the soul of the knife has been uncovered, one that is the essence, the being of the surgical profession.

References

1. Ochsner J. The Surgical Knife. Bull Amer Coll Surg 1999; 84:28.
2. Ellis H. A History of Surgery. London: Greenwich Med Media Ltd, 2001.
3. Selzer R. Mortal Lessons. New York: Simon & Shuster Inc., 1974.

Chapter 43

The Search for Meaning in Surgery

Luis H. Toledo-Pereyra

More than fifty years have passed since the original work of Victor E. Frankl (1905-1997), *Ein Psycholog erlebt das Konzentrationslager*, came to light in Austria. Approximately a decade later, it was published in the United States under the title of *Man's Search for Meaning*. In it, the internationally respected psychiatrist, Frankl, described his horrific experiences in Auschwitz during World War II and constructed his extraordinary thesis on finding meaning in suffering. His discovery did not end at this point; he introduced the school of logotherapy, which focused on the meaning of human existence and on man's search for such meaning.[1] So how can a surgeon or surgeon-scientist directly apply Frankl's theories to his or her frame of reference? A surgeon needs to examine and extrapolate Frankl's theory to a surgeon's commitment and dedication in his or her daily living. Let me explain my supposition.

Surgery is a highly charged and strenuous profession where life and death are frequently encountered under difficult circumstances. Patients are transported to a state of unconsciousness in the performance of the surgical act, and occasionally irreversibility of cure is a fact. Some patients may not return to their beds or formerly active lives. Within these circumstances, it is important that surgeons remain actively involved in finding meaning in their profession, in their lives, or as Frankl accurately put it:

> *We must never forget that we may also find meaning in life even when confronted with a hopeless situation, when facing a fate that can not be changed. For what then matters is to bear witness to the uniquely human potential at its best, which is to transform a personal tragedy into a triumph, to turn one's predicament into a human achievement.*[1]

Even though surgeons understand that it is not possible to save all patients and life or deformity might be at stake, this acknowledgement does not ease their minds and their hearts. Yet according to Frankl, there is an incredible opportunity in finding meaning in despair. And, here it is where surgeons must direct their attention, for themselves and for their patients. For themselves, surgeons will find meaning in the realities of their patients' lives; they will encounter understanding in the worlds of exemplary surgeons of the past; they will define the limitations of their profession, and they will be the dominant source of knowledge and wisdom. For their patients and more importantly, perhaps, for their patients' families, surgeons will become aware of the realities of what can be done under a given situation. Surgeons will carry the torch of communicating the extraordinary hopes of future patients who will be ahead by applying the concepts learned through their particular cases. They will be ardent supporters of the possibility of finding meaning in suffering, of turning their predicaments into human achievements, as effectively argued by Frankl.[1]

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Now, how can the process of finding meaning be taught to practicing or scientific surgeons? How can we offer clear advice for the development of meaning under professional or family life circumstances? How is it possible to offer a well-defined approach to encounter meaning for both young and experienced surgeons? First of all, knowing that meaning exists in surgery and believing that it can be found is the most important and primordial part of the equation for finding it. Second, the significance of pursuing the reason for meaning in surgery cannot be oversimplified. Third, following the principles of Frankl's school of logotherapy, surgeons need to "actualize the potential meaning inherent and dormant in a given situation."[1] Fourth, realizing that the loss of a patient's life will ultimately help surgeons in the future and under different circumstances, offer a new goal for meaning inasmuch as aiding surgeons to communicate with the relatives of those patients who have left our world forever. In short, these four principles—based in great part on the teachings of Frankl—should be the foundation for a well-defined approach to encounter meaning in the professional life of surgeons.

Academic surgeons also will find meaning in the education of young surgeons. They will see their careers as transcending with the experiences of the new members of the clan. They will take pride in encouraging others to work, live, and function as they do. They will see their responsibility as perpetuating the life of surgery, as giving new meaning to old and recently introduced surgical techniques, and as maintaining the spirit of a discipline probably as old as the creating of life itself.[2]

Surgeon scientists will find meaning in discovering new principles, in confirming new hypotheses, and in solidifying important results to bring about new ways of effective treatment. Surgeon scientists will teach with special satisfaction the young generation of surgeons who aspire to include research as an important part of their daily endeavors. Surgeon scientists will actively pursue those novice surgeons who demonstrate a dedicated interest in understanding the scientific basis of surgical problems and in attempting to learn how to present and discuss their surgical innovations.

Surgeon writers will find meaning in the accurate depiction of their characters in particular and the description of the surgical profession in general. They will seek discussions oriented towards a better understanding of the surgeon's world. They will write to introduce the benefits of surgery into those who have not had the opportunity to assimilate the advances acquired in the last few decades. Through their writings, they will present the great adventures of surgical pioneers and the stories behind their particular contributions. Surgeon writers will be the voice who will narrate the episodes of surgical history.

In closing, the surgeon's search for meaning is critical to the better understanding and preparation of the surgeon's specialty. Finding meaning in the work and life of surgeons of the past will be reassuring and very much worthwhile. Furthermore, patients and family members expect a contribution from their surgeon in the search for meaning. It is at this moment then that surgeons and patients become members of the same team and will carry the same ideals in their search for meaning.

References

1. Frankl VE. Man's Search for Meaning. New York: Pocket Books, Simon and Schuster, 1985.
2. Toledo-Pereyra LH. Epocas de la Cirugia. In: Toledo-Pereyra LH, ed. Cirugia, Arte y Cultura. Mexico, DF: JGH Editores. Editorial de Cienca y Cultura Latinoamericana, 1998:15.

Chapter 44

Cushing's Way

Lucretia W. McClure

Imagine you are a third-year medical student in 1920 and you are listening to Harvey Cushing's clinical lecture on a case of splenic anemia. After discussing the patient who was presented to the students, Cushing begins to outline what he read before coming to the session. He not only tells the students what he read, but gives a clear description of the nature of the publications and why he selected those particular items.

In the 21st century when medical students are surfing the Internet for information, using sources such as Up-To-Date and MDConsult for books or concise reports on medical topics, and avoiding sources that are not electronic, the Cushing model for what to read and why is both relevant and urgent.

Cushing chose first Barker's *Clinical Diagnosis of Internal Diseases* because of its "brevity of description and valuable bibliography."[1] He states that the last edition of Osler's *Principles and Practice of Medicine* is perhaps the "best jumping off place for most subjects, whether surgical or medical."[2]He then goes on to cite a variety of authors and provides this succinct roadmap to reading and learning.

"Thus in looking up a subject one proceeds, from a brief synopsis, to a textbook, to such short monographs as occur in standard system of medicine, to separately printed and larger monographs, and as a last court of appeal to the general literature of our journals through the agency of our great indices".[3]

He ends the discussion by encouraging the students to be students of medicine for the rest of their days, and to learn how to assemble facts relating to disease. He also suggests that one can "learn to practice medicine successfully with a very few drugs well used, and will become the better surgeons for conservation in use of the scalpel."[4] Certainly, no student who participated in these sessions with the noted neurosurgeon, ever forgot the experience.

Today's students and practitioners have a vastly different approach to literature. With an array of electronic resources available at the stroke of a keyboard, does anyone want to sift through a half dozen books on the topic? There is no need to scour the printed indexes for the databases produce bibliographies of articles at the desktop. Cushing introduced his students to a pattern of reading. By limiting their reading to only what is available online, the students of today can miss the serendipitous finding that occurs when browsing the library's book collection or thumbing through journal issues.

Medicine is no longer contained in the traditional basic science and clinical subjects. It is necessary to use sources in physics, anthropology, chemistry, and the social sciences, and many other areas. In the arena of healthcare there are topics such as medical economics, bioethics, and delivery of healthcare that must be included.

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Reading widely brings new ideas and philosophies, helps the reader to distinguish between the good and the poor literature, and is essential as preparation for writing.

Being a competent computer searcher does not guarantee that the surgeon or student has mastered the skills to evaluate articles and books for quality, to determine the authenticity of websites. Just as a patient would expect that his surgeon learned anatomy by working with a cadaver, so he would also expect a surgeon who was steeped in the literature of his field, the history, the developments, the controversies, as well as the latest innovations.

Cushing was a brilliant and bold neurosurgeon who made great strides in a relatively new field. Called the father of neurosurgery, he was also renowned as a scholar, author, artist, bibliofile, and teacher. It is interesting that his article on the case of splenic anemia is on page one of the first issue of the *Archives of Surgery* in 1920. Often called the greatest neurosurgeon of the 20th century, he created many innovative devices to assist in surgery. His biography of his mentor, Sir William Osler, was awarded the Pulitzer Prize for literature in 1926, and his rare book collection of some 8,000 volumes formed the nucleus of the Cushing/Whitney Library at Yale Medical School. The twenty-two residents he trained in neurosurgery all became full professors or chiefs of neurological services and they continued the Cushing way of teaching. What a legacy he left!

Another well-known surgeon, Sherwin B. Nuland, is also an author and historian. After his retirement from surgical practice, he wrote about why he chose surgery, the changes in its practice during the past years, and why he is not sorry to be out of the operating room. He states that the changes he experienced foretell others, that the specialty that was his passion will no longer be recognizable.[5] In these words he makes clear the reason why: "were I made to choose a single *diagnostic* attitude that epitomizes the difference between the surgeons leaving and the surgeons coming, it would be the startling shift in emphasis from the patient to the instrumentalist The general surgical resident of my day struggled mightily to become a master of the physical examination; the general surgical resident of today struggles mightily to become a master of the menu".[6]

From Cushing came the kind of teaching that prepared students through the printed word and his vivid descriptions of disease and treatment. Nuland's outline of the changes in surgery from the days of the Renaissance to the remarkable achievements of today reveals a paradigm shift from the focus on the patient to the instrumentality, the impersonal technologies now in use.

The changes in how medical literature is used parallels these two ideas. No longer does the student follow a systematic program of reading as did those of Cushing's day. Again the "instrumentality" has come between the book and the student. This instrument is the computer and while it has remarkable capacity to locate information, it does not have the breadth and depth of a library's collection with a wide array of subjects and formats. A recent editorial in the *Boston Globe* points out that the 20-page term paper, once a "rite of passage for high school history students," has largely gone the way of the slide rule. The editorial quotes Will Fitzhugh, publisher of *The Concord Review,* who worries about the fate of the research paper. He says the decline in writing goes hand in hand with a decline in serious reading by students.[7]

These high school students will become our medical students, our future practitioners. Medicine has a rich and varied literature. We will shortchange our students if we do not entice them to the feast that resides in our medical libraries. The content of the literature is the key to learning; the instrument is a tool, not the basis for choice.

References

1. Barker LF. The Clinical Diagnosis of Internal Diseases. New York: Appleton, 1916.
2. Osler W. The Principles and Practice of Medicine, Designed for the Use of Practitioners and Students of Medicine. 9th thoroughly rev. ed. New York: Appleton, 1920.
3. Cushing H. Two cases of splenectomy for splenic anemia. Arch Surg 1920; 1:6.
4. Ibid., 14.
5. Nuland SB. A surgeon's valedictory. Perspect Biol Med 1994; 37:161-165.
6. Ibid., 166.
7. Editorial: Emulating Emerson. Boston Globe, 2004:C10.

Chapter 45

The Ethics of Surgical Research

Luis H. Toledo-Pereyra

Ethics is not a new discipline, but rather one as ancient as philosophy itself. At the very beginning of civilization, early Sumerians recognized the importance of justice and moral principles.[1] With this in mind they created the Hammurabi Code based on a strict and similar retribution to the damage incurred. The discipline of surgery has a long history as well, and the study of both surgery and ethics has greatly influenced the practice of medicine.

Surgical research is a close and important ally of surgery itself. Surgeons, researchers, and surgeon researchers have all united to define and expand the surgical field based on the most advanced modern concepts. Essential to the understanding and practice of surgery is the study of ethics. Apart from ethics, surgery cannot be conceived and appreciated. But even more significant is the application of ethics in surgical research, since this discipline highlights the importance of experimentation in animals and human beings.

Essentially, the ethics of surgical research refers to the application of good and reasonable behavior to the best moral care of animals and people, as well as the development and implementation of good laboratory practices in the detailed execution of experimental studies. To perform sound and acceptable surgical research, the surgeon researcher must adhere to the ethics of the discipline. Executed with the best science available, good research entails a series of stages—the conception of a research project, the ideal care of experimental subjects, and the appropriate interpretation of data. The consummation of these stages of surgical research allows for science and ethics to collaborate intimately, thereby achieving the best results.

Since modern times, when the extraordinary French physiologist Claude Bernard (1813-1878) began experimenting on animal subjects, the use of surgical research has increased exponentially. Bernard's interest in experimentation was kindled by his teacher, Francois Magendie (1785-1855), who demonstrated in animals that the spine's dorsal nerve roots were sensory whereas its ventral roots were motor. Bernard advanced Magendie's work by investigating how these nerve impulses were transmitted and blocked.[2] In 1865, Bernard wrote his monumental work on experimental medicine, declaring here that it was appropriate to use animals for research purposes.[3] Later on, he would use animal experimentation to study the use of substances for the mitigation of pain.

In the GrecoRoman world, Galen (130-200) experimented a great deal with animals. His studies permitted the development of theories and assumptions that practically paralyzed the acceptance of newer concepts until the successful challenge put forward by Vesalius (1514-1567) during the Renaissance.[4] William Harvey (1578-1658) and Robert Hooke (1635-1703) engaged in animal research to

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

authenticate their principles of circulation and respiration with sound experiments.[4] These scientists did not consider or present ethical considerations in their research. In fact, no one previously had mentioned or even appreciated the role of ethics in animal research. Bernard would be the first to take preliminary steps toward the integration of ethical ideas in animal research with the assertion that pain was not acceptable in the course of animal experimentation, and that anesthesia should be used to lessen its presence.[2]

The year 1876 brought animal experimentation to the forefront when the British passed an act regulating the research of animals.[2,5] Protection from pain was the main issue, but the act also stated that animal studies could only be permitted for well-planned research, not for public demonstrations or teaching.[2] This act was the solid foundation for the ethics of surgical research, but Americans responded unsuccessfully to the challenge. The proposed American legislation (Gallinger Bill) had ideas similar to the British Act, but further emphasized the development of goals, both clinical and physiological, during the research process. This bill did not reach consensus through the legislative process, and its passage was stalled. Organized medicine (American Medical Association) and medical research groups vehemently opposed this legislation, only to come up with their own guidelines in the early 1900s. These guidelines stressed the living conditions of animals, particularly those conditions under which the experiments were conducted.[2]

Several decades later, following World War II, the United States refocused its attention on biomedical research and animal experimentation. Consequently, national policies began to evolve. The Guide for the Care and Use of Laboratory Animals of 1985 (revised in 1996) and the Public Health Service Act of 1986 became the basis for the current guidelines under which animal research is performed in this country.[2,5] The highest ethical principles were pursued through these regulations. The Office of Laboratory Animal Welfare at the National Institutes of Health supervises the activity of local Institutional Animal Care and Use Committees, securing in this way the utmost standards of integrity in the practice of animal research.

In comparison, what are the guidelines regulating the research in human subjects in this country? Notably, the United States regulations are more advanced than the Nuremberg Code and the Declaration of Helsinki. The use of independent review boards (Institutional Review Board or the Research Ethics Committee) has improved the conditions of ethical research, as well as the opportunities for research subject protection. Careful analysis of the research design with emphasis on individual autonomy, and the equitable selection of candidates with optimal risk/benefit ratio, together comprise the basic tenants for the practice of morally acceptable clinical research. In this regard, the U.S. government has developed several offices dealing with research integrity and protection of human research subjects. The Office of Scientific Integrity, now known as the Office of Research Integrity in the Department of Health and Human Services (DHHS), actively participates in maintaining high-quality standards of scientific research. The Office for Protection of Research Risks, now functioning as the Office of Human Research Protection, also associated with the DHHS, is a complementary office oriented to maximize the opportunity for the protection of human subjects undergoing research.

In summary, the ethics of surgical research should adhere to the most stringent requirements of animal and human protection. Research is second only to the care of experimental subjects. Ideally, research and ethics work hand in hand in the development of the most advanced surgical research guidelines. In essence, a surgeon researcher without ethics is unfit to practice the science of experimentation in the surgical field.

References

1. Garrison AH. An Introduction to the History of Medicine. 4th ed. Philadelphia: WB Saunders, 1929.
2. Brody BA. The Ethics of Biomedical Research. An International Perspective. New York: Oxford University Press, 1998.
3. Bernard C. Introduction to the Study of Experimental Medicine. New York: Dover Press, 1957.
4. Lyons AS, Petrucelly IInd RJ. Medicine, An Illustrated History. New York: Harry N Abrams, 1978.
5. Orlands FB. Data on animal experimentation in the United States. Perspect Biol Med 1994; 37:217-231.

Chapter 46

American Research Leadership and Ingenuity

Luis H. Toledo-Pereyra

Europeans brought the first wave of technology to Colonial America, where Americans promptly assimilated the old country advances while adding their own individual perspective. Early Americans, though imaginative, were principally attracted by practical inventions from which one could obtain direct benefit. Pragmatism, economics and success served as the basis for discovering and applying new technology. One American, however, rebelled against this prevailing view and began experimenting with and implementing his ingenuous ideas. Benjamin Franklin (1706-1790) was among the first leaders in this young nation. Self-taught, he tackled such important matters as electricity, the lightning rod, the movement of the Gulf Stream within the Atlantic Ocean, the advantages of daylight-savings time, and calming rough seas by pouring on oil. Franklin's ingenuity continued throughout his lifetime. He introduced bifocal lenses within a single frame to accommodate both distance and close-up use. He developed a more efficient stove that used less fuel. He taught local farmers how to improve acid soil by adding lime. He also invented a machine for duplicating handwritten documents, a simplified clock, and the Armonica. He refused to patent his inventions, preferring them to be used for the good of the people.[1] Thus, his generous heart was more than a match for his inventive mind.

Another eminent American, Thomas Jefferson (1743-1826) was Franklin's junior by almost 40 years and offered to the infant republic more evidence of leadership in scientific inquiry. Jefferson's life accomplishments epitomized the essence of a Renaissance man. His scientific grasp was as profound as that of the recognized scientists of the time. He diligently explored astronomy, mathematics, medicine, and botany. He invented many devices and hand tools, including a wheel cipher and a mouldboard for ploughs. Jefferson called science his passion and politics his duty, and affirmed, "Science is more important in a republic than in any other government".[2] He championed government support for the sciences and created a positive environment for scientific growth and initiative. No wonder Bedini, one of Jefferson's distinguished biographers, called him a *Statesman of Science.*[2]

A great American mind of the times, William Beaumont (1785-1853), a military surgeon, excelled in clinical medicine. His treatise, *Experiments and Observations on the Gastric Juice and the Physiology of Digestion* (1833), recorded observations of Alexis Saint Martin, a Canadian shot in the stomach. Beaumont studied the digestive system through the resulting gastric fistula. His publications made him an international celebrity, a first for an American medical doctor. His leadership and commitment to research were the key ingredients to his extraordinary success.[3]

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

The development of surgical anesthesia put American researchers in the forefront of medicine. Crawford W. Long (1815-1878) was the first to use ether in 1842 when he removed a tumor from the neck of James Venable. In the mid-1840s several people experimented with anesthetics: Horace Wells (1815-1848) used nitrous oxide and William T. G. Morton (1819-1868) used sulfuric ether at the suggestion of Charles T. Jackson (1805-1880). While controversial ambiguity existed regarding the founder of surgical anesthesia, there was no doubt these four Americans pioneered pain mitigation during surgery at a time when Europeans dominated medicine.

During the Civil War (1861-1865), scientific pursuits were secondary to the fraternal struggle for internal supremacy. Yet this country emerged more defiant in the application of surgical techniques honed on the battlefields, in the management of mass casualties and public health policy.[4,5] Americans asserted themselves by implementing relevant principles of medical practice and displaying leadership qualities even under conditions of need and sacrifice. 46

During the 1890s world attention often centered on Europe, where Pasteur, Lister, and Koch received immense medical recognition. The seriousness of the American enterprise was underscored during this time when William Henry Welch, William Osler, William Halsted, and their colleagues developed Johns Hopkins Medical School as the premier medical institution in the world. While Americans still had significant hurdles to overcome, leadership in research was creating the force and enlisting the spirit that would be all-American. Nobel Prizes in large numbers, important discoveries, better treatments, and improved methods of research and education signaled a new environment in which Americans emerged as the leaders.

Today, we celebrate this legacy of leadership in research throughout the entire nation. Today, our communities are empowering active participation in all new research advances that are now available to people far beyond city limits. Today, we celebrate our commitment and enjoy the fruits of hard work and dedication to research and academics. Today, we can clearly see the unfolding story of American ingenuity and leadership.

References

1. Franklin B. The Autobiography and Other Writings. New York: Penguin Books, 1986.
2. Bedini SA. Thomas Jefferson: Statesman of Science. New York: Macmillan, 1990.
3. Duffy J. The Healers: A History of American Medicine. Urbana: University of Illinois Press, 1979.
4. Toledo-Pereyra LH. Nineteenth century of american medicine. notes from history course. Kalamazoo: Western Michigan University, 2001.
5. Toledo-Pereyra LH. Origins of American Medicine. In progress.

Chapter 47

Advice from a Committed Scientist

Luis H. Toledo-Pereyra

If surgical investigators were privileged enough to be addressed and advised by the Wizard of Menlo Park, Thomas Alva Edison (1847-1931), undoubtedly, his words would contain the following advice:

Dear Surgical Investigator,

Your profession is a unique one, reflecting the intense dedication of individuals committed to the investigation of surgical problems. Dealing with diseases that affect the human body and attempting to discover cures—clearly beyond my area of expertise—as well as studying why certain therapies work and why certain procedures are better than others, together create a complex situation that requires an extraordinary commitment from anyone involved. Though what I convey to you may not be unique, still let me try to express my principles associated with innovation and research.

Let me begin with my life and experiences, hoping to stimulate within your spirit those same feelings that uplifted and compelled me. I did not go to school for very long, since my teachers could not tolerate my inquisitive and rebellious attitude. My dear mother, Nancy Elliot, taught me at home everything I knew. I was born in a Midwestern town, Milan, Ohio, near Lake Erie, in 1847.[1-3] Inventions were few during this time of headlong westward expansion. A few years later in 1854, we moved to Port Huron, Michigan. There I began working at the age of 12, selling snacks and newspapers on the Grand Trunk Railroad, which made the roundtrip to Detroit.[4] I learned a great deal from this experience, particularly, regarding the importance of punctuality and responsibility. In the winter of 1860, I began reading my father's copy of Thomas Paine's (1737-1809), *The Age of Reason.*[4,5] This without a doubt the best book I have ever read, and I would recommend it to you without hesitation. This book reflects Paine's revolutionary views in religion and society, and reveals a better view of the philosophers of Enlightment. Truly, this book is one to be cherished.

From 1863 to 1867, I worked as an itinerant telegrapher, a trade that would be to my advantage in the years to come. In your case, sustained interest in all knowledge pertaining to surgical investigation is the key to your future success. In 1867, immediately after the Civil War, I moved to Boston, where I experienced the tantalizing intellectual life of a great cultural center. Just months later, I moved to New York, the greatest metropolis in the country, where I was given the permanent position of telegraph operator at the Western Union Company.[1-5]

My life was quiet and without any major developments up to this point, even though I continuously pondered ways to improve our daily function in society. My

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

advice at this point concerns your dedication to thinking. "The brain can be developed just the same as the muscles can be developed, if one would only take the pains to train the mind to think. Why do so many men never amount to anything? Because they do not think."[4,5] I believe this applies clearly to surgical investigation, a discipline in which thinking is of paramount importance. Think all the time; in fact, do not stop thinking at any moment.

My apologies for persisting in this topic of thinking, but, I consider it to be the most significant aspect of my advice. "The man who doesn't make up his mind to cultivate the habit of thinking misses the greatest pleasure in life. He not only misses the greatest pleasure, but he can not make the most of himself".[5] Failure without thinking is as bad as failure without trying. Failure with thinking amounts to something that with hard work and perseverance will ultimately lead to success. For the surgical investigator to be successful, he/she needs to remain faithful to the thinking process. Do not hold your thinking at anytime, but instead, continue to build your powers of observation and one day you will have a highly trained brain that will be able to see everything, to see it all. 47

In 1869, in the preludes of the industrialization and the Gilded Age, when I was 22 years old, I obtained my first patent for an electronic vote recorder and entered my first partnership with Frank Pope. I had to learn not only the applicability of science, but also the best means by which to do business. Self-education and dedication contributed a great deal in my daily working endeavors. The same will remain true in your experiments dealing with surgical problems: the more knowledge and commitment you profess to the elected field of surgical investigation, the more rewarding the result.

It has not escaped my notice that I have been categorized as ambitious, aggressive, rebellious, single minded, self-centered, imaginative along with so many other characteristics.[4] I accept these charges with the condition that I be considered an independent thinker, someone whose only purpose was to invent and invent. In order to be independent and be able to invent, a researcher needs a facility that can offer the best for proficient laboratory work. Get your own laboratory, if you can, one that you can use anytime with any ideas you might have. In 1876, near the end of Ulysses Grant's presidency and the year of the invention of the telephone by Alexander Graham Bell, the Menlo Park Laboratory opened its doors, so I could tinker with any idea that crossed my mind.[4] I was the only inventor with a research facility of this magnitude. No one else had anything similar. If you are interested in research as a surgical investigator, it is vital to participate in a laboratory that offers the best available in research equipment and laboratory personnel. Never settle for less!

Some have questioned the 1093 patents that were issued to me alone or jointly in the course of my lifetime. I did not plan to obtain so many patents. They originated from my interest in the various fields of innovation. The greatest number were in the field of the electric light and power (389), followed by those associated with the phonograph (195), the telegraph (150), the storage battery (141), and so many other fields of life and industry. Do not let these accomplishments or those of others derail your path of consistent research. If you are to reach the answers you need to improve health and overcome disease, you will require to maintain a vigilance for obtaining the best results under the best possible conditions. Remain alert to new advances in your field and to those of your research competitors.

Advance your knowledge constantly, visit other laboratories and form special coalitions with other researchers in the field. Identify your friends, as well as those that do not support your causes and findings. Do not overemphasize the role of the latter in your life. Focus attentively in all facets of your research and make progress by carefully following details and threads of evidence. Work constantly and nap sometimes. Work at night, if you can. Working hard keeps your mind crisp and your spirit high. Do not overlook the benefit of dedicated labor.

I failed to mention to you thus far that at an early age, I lost a great deal of my hearing. This tragedy became a blessing as I began enhancing other senses as a substitute for my poor hearing. My ability to concentrate considerably increased, my distractions significantly diminished and I became an excellent reader.[5] I am not recommending to you, to lose your hearing to replace it for higher senses but the qualities mentioned could be continuously exercised so, your research can consistently improve.

Not surprisingly, my approach to life was unorthodox. I had an adversarial relationship with many people, I did not conform to established order, I was brash and undiplomatic. I had my own ethics and standards and I followed my own advice.[4,5] I do not recommend this same path for you, and let me explain why. Since I did not have a superior above me, it was not that risky to act as I did. Given today's job market, I would understand that it would be prudent to follow a different approach. Remember, what is important is to remain free in spirit and thought as much as you can, while at the same time considering the critical role of regulations and authority. In this way, you can continue being employed for a long time. Under these or any conditions, never sacrifice your honesty and integrity over the job you possess, whatever it might be!

It is noteworthy to mention to you, that there were always two characteristics to my inventions. One, the invention must be practical and intended to make money[5] and two, the invention must correlate with current interest so that people realize its importance.[5] Briefly stated, "Anything that won't sell, I do not want to invent. Its sale is proof of utility and utility is success". "A scientific man busies himself with theory. He is absolutely impractical. An inventor is essentially practical".[5] Though these thoughts accurately reflect my own personal experience, I realize that they won't apply absolutely to all research. You might be able to apply part of these truths to your surgical investigations, attempting to reach practicality while still recognizing some theoretical advantages for your experiments.

I have already alluded to the role of long and patient labor. Nothing is as important as this concept. Invention does not come from luck; it comes from long and committed hours, days, weeks and months of intense sacrifice. Do not allow yourself to become discouraged under any circumstances.[5] Charge ahead without excuses. There are none!

I made many mistakes in my life and perhaps the most significant is the one associated with the complete resistance I had for second-generation improvements of my inventions.[5] In spite of being the first to invent the phonograph, electrical system and motion picture, I did not realize the importance of new additions to the initial inventions. Instead, I stubbornly persisted in maintaining intact the first generation invention and because of this others realize the benefit of improved additions. What a serious mistake. My clear advice to you is to actively participate in any changes in research so, you can continue advancing your initial developments. Again, don't do what I did.

I regret not being able to offer you all the lessons and instructional experiences derived from the wisdom of my long existence. However, I hope that those I could provide were helpful to you in improving your ability to succeed in your career and your life as a whole. In closing, I would like to leave you with the final statement expressed by Robert Conot, one of my most accomplished biographers:[4] "Edison succeeded because he was an eternal optimist who would not let himself or others consider the possibility of failure; because he was an unconventional thinker, who accumulated the resources that enabled him to transform his ideas into reality; because he charged ahead when others hung back; because he demolished the opposition and bowled over impediments he was the product of a unique conjunction of talent, ambition and opportunity. There was never anyone like him before. And, in the hundred years since, the world has changed so radically it is highly improbable that there will ever be anyone like him again".

With my best consideration for a successful life of extraordinary developments in surgical investigation.

Truly Yours,
TAE

References

1. Israel P. Edison. A Life of Invention. New York: John Wiley & Sons, 1998.
2. Baldwin N. Edison. Inventing the Century. New York: Hyperion, 1995.
3. Millard AJ. Edison and the Business of Innovation. Baltimore: Johns Hopkins University Press, 1990.
4. Conot R, Thomas A. Edison. A Streak of Luck. New York: Da Capo Press, 1979.
5. McCormick B. At Work with Thomas Edison. Canada: Entrepreneur Press, 2001.

Chapter 48

Art and Surgery

Luis H. Toledo-Pereyra

Art is as vital to the surgical profession as science itself. Surgeons can nurture themselves with the sensitivity and creativity of the art world. The surgeon as an artist works in the human body with diligence and care. Without the daily benefit of artistic expression, the surgeon's work would be incomplete. I would suggest, then, that clinical programs incorporate some art form in the training of future surgeons.

The understanding of the human body, its forms, contours, and plasticity are critical to the student of surgery. The integration of human tissues, the disposition of internal organs, their constitution and reconstruction are basic to the practicing surgeon. The human body is also critical to the artist, so art can become a reality for both the surgeon and the artist. Art gives wholesomeness, understanding of esthetic functions, development of detail in the configuration of organs and tissues, and, most of all, appreciation of the human body within the context of the biological system.

As art has advanced, surgery also has reached significant heights. Artists have conceived new forms and applications and surgeons have encountered new means for organ repair and disease treatment. The symbiotic relationship of art and surgery can propel both to new levels of professional excellence, where both disciplines can maximize the characterization of their expression.

If art helps the surgeon improve technical skills, it would be reasonable to stimulate frequent communication between artists and surgeons. Could the surgeon's technical skills be enhanced by the artistic experience? Or does the surgeon study and practice art to improve his conceptualization of the artistic form? Both questions can be answered truthfully in the affirmative: artistic experience will improve the surgeon's perception of the surgical process and, of course, the study and practice of art will create an environment of attention to artistic detail that will potentially translate into better surgical technical results.

The operating theater, the most sacred cathedral in the surgeon's world, offers the perfect setting in which great events can unfold. Surgeon, patient, room, and circumstance occupy the evolution of the surgical science and the art of our profession. Sherwin Nuland, distinguished surgeon-writer, in his introduction to *Doctors, The Biography of Medicine*, reminds us that Dr. Francis Peabody, in addressing his Harvard students, indicated the critical importance of not letting the science of medicine interfere with the art of medicine. They are not antagonistic but supplementary to each other,[1] he said. These remarks become more expressive and fundamental in the study and practice of surgery.

No artist transformed canvases in the way that Thomas Eakins (1844-1916) of Philadelphia was able to do. He recorded the operating room, the surgeon, the pa-

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

tient, their relatives, the students, the blood emanating from the surgical procedure, and all details of the operation.[2] His incredible art could only enhance viewers' understanding of the operative event. Art and surgery are indivisible in his *Gross Clinic* (1875), the greatest painting of 19th Century America. Eakins continued to meld artistic expression and surgery with his monumental work on the *Agnew Clinic* (1889), completed several years later but with equal signs of meaningful grandiosity. Eakins was teaching the value of art in the perception of surgery and advancing the best of art and surgery. Both were depicted as inseparable, constituting a unified, essential, and transcendental whole.

In recent times, other artists (some of them surgeons) have portrayed the kinship of art and surgery. I have singled out three artists who are also surgeons, reaching for full artistic expression. Joe Wilder, well-recognized orthopedic surgeon, has used the various stages of the surgeon's life in the operating theater to artistic advantage.[3] It is refreshing and very educational to conceive in good art the surgeon's creative and therapeutic range. Another outstanding surgeon-artist, Roy Calne, noted English transplant surgeon, has used his brushes and canvases to capture the expression of patients and physicians associated with liver transplantation and surgical events.[4] His art is firm, strong, and realistic. Gerald Marks, a well-known colorectal surgeon, frequently expresses his art through extraordinary watercolors that focus on the exceptional virtues of nature and particularly those reflected in the landscapes around the world with a major emphasis to Italy's countryside.[5] An increasingly expanding group of surgeons/artists belong to the American Physicians Art Association, established to promote the commitment of physicians and surgeons to the concept of art and its expression.[6]

Art and surgery are closely related allies. Art can enhance the surgeon's world. The surgeon can contribute a great deal to artistic expression and its endeavors. Surgeons bring soul and the spirit of their profession to their roles as artists. Art is essential in surgery. The relevance of the artistic expression in the surgeon's life is basic to the surgeon's development as a professional and as an individual.

References

1. Nuland SB. Doctors. The Biography of Medicine. New York: Vintage Books, 1988.
2. Toledo-Pereyra LH, Thomas Eakins. Genio Excentrico, Pintorde Cirujanos in Historia, Cirugia y Cultura. Mexico: JGH Editores, 1998.
3. Schwartz SI, Wilder J. Surgical Reflections. Images in Painting and Prose. St. Louis: QMP Inc., 1993.
4. Calne R. Art, Surgery and Transplantation. London: Williams and Wilkins, 1996.
5. Marks GJ. A Watercolor Painting. General Surgery News 2001; 22.
6. American Physicians Association. JimMurielB@aol.com, Fall 2000.

Chapter 49

Poetry and Surgery

Luis H. Toledo-Pereyra

Surgeons must be careful
When they take the knife!
Underneath their fine incisions
Stirs the Culprit—Life!
—Emily Dickinson (1830-1886)

Emily Dickinson, the revered Massachusetts poet, wrote one of the few poems about surgery that is preserved in surgical science literature. Dickinson did not publish further on the poem's meaning.[1] Other poets and scholars have not discussed its significance either. It appears, probably, that Dickinson intended to call attention to the important role of the surgeon (and his knife) and the significance of life as the final reason for all things. Surgeons respond to crisis and perform strenuous work. Surgeons preserve life and maintain physiology. On a daily basis, surgeons are vitally aware of the responsible element—all in all, life itself!

Emily Dickinson aside, how many people commonly associate poetry with surgeons? Very few, I imagine, since surgeons are frequently associated with the stereotype of being absorbed by the physical phenomenon, without demonstrable contribution to the literary scene. Traditionally, surgeons have been considered to have a practical attitude with a pragmatic response to clinical problems, attending only to life and death situations.

Surgeons have not been poets throughout time. Is this because they do not have the aptitude to explore poetry? Or is it because they do not have the time or the inclination to pursue this ancient artistic expression? I reject the first supposition since lack of surgeon poets throughout time is not an issue of competence. Instead, I propose that it is an issue of dedication and interest in the field. I would entertain the possibility that time represents the most important consideration to put forward under these circumstances. In addition, surgeons have not found poetry to be a mechanism for advancement in the surgical arena. Then, I need to demonstrate the benefits that writing poetry can have on surgeons.

In the best of conditions, how can a surgeon or a scientist improve his or her professional delivery through writing poetry? A simple answer cannot be given to this complex question. The story that comes to mind is more in the cultural and literary field that creates an atmosphere of contentment and self satisfaction for the improvement of self and the rest of one's surrounding environment.

Let me bring an even more difficult and unexplored question: Are surgeon poets better surgeons? No definitive answer is forthcoming since there has been no cultivation of the poetic art within surgical training or surgical practice at all. One would

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

need to begin offering the possibility of making this discipline available to those who show some genuine interest so that an answer can be explored.

With the permission of my audience, I would like to introduce one of my poems pertaining to some aspects of the surgical world.

Surgical Presence

Pain is the thing with wings
That flies ahead and carries on
That stays here and endures effect
That challenges us and forges on

Surgeons strip the pain
With resolute candor and technology new
With swift control and instrument on
With good books and help from above

Where is the knife in all of this?
Where is the instrument of kings?
Where do we go to find its niche?
Where does it go through mud and clean?

Let's bring the culprit—Life itself!
To land and open seas
To simple waters and rough weathers
To sin and virtue all together—Life itself!

For Wallace Stevens (1879-1955), the Pennsylvania business executive, corporate lawyer, and one of America's finest poets, his world, the world of business, was a kind of poetry.[1,2] Similarly, for me, surgery is a kind of poetry. If one assumes that surgery is an important part of our culture because it cures many of our citizens and if one considers that poetry is an art open to artists and all persons to express their life experiences, then one must conclude that the poetry of surgery can be expressed by surgeons, artists, and public on a more consistent basis. Yet this has not happened. Surgeons do not write poetry, and artists and the public do not face surgery frequently enough to write about it. Where does the answer lie, then? One would not know exactly, but surgeons, artists, and the public need to begin communicating about their lives and their changes as they pertain to surgery and its effects.

There are several surgeons who come to mind as distinguished surgeon writers, and most recently, we have seen the names of noted individuals, such as Sherwin Nuland, Richard Selzer, and others,[3,4] who have become part of the public domain as important examples of the contributions of these professionals to the world's art of expression and understanding. On the other hand, there are no identifiable surgeons whom I can recognize as surgeon poets. So, the art of poetry has not climbed the ladders of the surgeon's world to the point that one or various surgical specialists are writing about it. In the medical field, we have a different story. Books have been written about medical doctors expressing their poetic veins.[5,6] Well-known physician writers like Oliver Goldsmith, John Keats, Oliver Wendell Holmes, Arthur Conan Doyle, and William Carlos Williams are among the good number of poets of medical origin. Other recognized physicians in the medical world, such as Edward Jenner, Erasmus Darwin, Silas Weir Mitchell, and Charles Sherrington, have also contributed to Virgil's art.

At the end of this essay, my plea would be to encourage surgeons, artists, and patients to communicate their surgical experiences, challenges, and triumphs in the form of poetry. My wish would be to present to surgeons the need for expressing their thoughts as frequently as possible in poems of meaning and reflection. My goal would be to reach the surgeon, the public, and the patient in using their opportunities to ponder the surgical field and its benefits to humanity.

References

1. Conarroe J. Six American poets. An Anthology. New York: Vintage Books Random House, 1993.
2. Stevens W. The Collected Poems of Wallace Stevens. New York: Alfred A. Knopf, 1954.
3. Nuland SB. Doctors. The Biography of Medicine. New York: Vintage Books Random House, 1988.
4. Selzer R. Confessions of a Knife. New York: Simon and Schuster, 1979.
5. McDonough ML. Poet Physicians: An Anthology of Medical Poetry Written by Physicians. Springfield: Charles C Thomas, 1945.
6. Reynolds R, Stone J. On Doctoring. Stories, Poems, Essays. New York: Simon and Schuster, 1955.

Chapter 50

Solitude in the Surgeon's Life

Luis H. Toledo-Pereyra

> *It is only when we silence the blaring sounds of our daily existence that we can finally hear the whispers of truth that life reveals to us, as it stands knocking on the doorsteps of our hearts.*
>
> —K.T. Jong[1]

Solitude is the best unrecognized advisor that an intellectual can have. Solitude is like a dear old friend who knows you best and has the time to listen to your thoughts and fears. Solitude does not ask us any questions, and it does not reproach us under any circumstances. From my perspective, a person's ability to arrive at the best solution depends on his or her decision to seek the required solitude and to listen to the voice of silence. William Penn (1644-1718) once said that "*true silence is the rest of the mind, and is to the spirit what sleep is to the body, nourishment and refreshment*."[1] Everything changes when we do not have the time to find solitude. In today's world, the life of a surgeon or a surgeon-scientist is one of continuous commitment to work and minimal time to spare. Therefore, it is crucial to find and set aside time to experience the forgotten benefits of solitude.

Neither the surgeon nor the surgeon-scientist should make an important decision without pursuing solitude. Aldous Huxley (1894-1963) would concur when expressing, "*the more powerful and original a mind, the more it will incline towards the religion of solitude*."[1] Presently, solitude, peace, and serenity are rarely present in the surgeon or the surgeonscientist's armamentarium. So how is it possible to recognize solitude's real effect when there is no time to dedicate to the pensive art of reflection? And how can we attain wisdom if solitude is rushed?

If we assume that solitude is absent in the surgeon's world, how does the surgeon create time for this beneficial reflection period? Before a surgeon will truly make time for this undertaking, he or she must have the desire to be thoughtful, to review life's challenges, to dedicate his or her efforts to analyzing problems. This is the environment where solitude will flourish and have a magnificent impact. The precious time for seeking solitude should not interfere with studying for clinical cases, learning surgical principles, preparing for conferences, performing surgery, or seeing patients. Seeking solitude is appropriate when we are philosophizing, investigating the nuances of our spirit, and navigating the ways of our soul.

Like any other important undertaking in life, we need to adjust our lives and dedicate a certain amount of planning to the pursuit of solitude. "*No man should go through life without once experiencing healthy, even bored solitude in the wilderness, finding himself depending solely on himself and thereby learning his true and hidden strength*" (Jack Kerouac (1922-1969)[1]). We should establish a well-designed

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

program to recognize and stimulate the extraordinary state of solitude. In this regard, a plausible approach might consist of:

1. Determining the most conducive time of day for embracing a solitary state.
2. Selecting the best physical environment where solitude can be sought.
3. Recognizing all detractors from active participation.
4. Establishing well-drafted guidelines for continuous progress.

Even with all these suggestions, the path of solitude may not be smooth; after all, it is a territory not frequently traveled by the practicing surgeon or the surgeon-scientist.

Although time is sparse and the path is uncharted, there are several benefits to seeking solitude. These benefits include self-exploration, self-preservation, reaching that unique level of personal communication, and having the opportunity to understand our failures and accomplishments with a peaceful and open state of mind. Seeking solitude is not a small task when we consider that our whole life and future as human beings is highly dependent on our possibilities to use solitude as a strong ally to better define our role in science, medicine, and society.

If we go back in surgical history and review the lives of some prominent surgeons, we can see how they sought and benefited from solitude. The careers of John

Hunter (1728-1793), Samuel David Gross (1805-1884), Joseph Lister (1827-1912), Christian Albert Theodor Billroth (1829-1894), William Stewart Halsted (1852-1922), Owen Harding Wangensteen (1899-1981), and Alexis Carrel (1873-1944)[2-5] are clear examples that dedication to surgery or surgical research is not opposed to exercising time outside of the surgical discipline to entertain solitude and the humanistic endeavors in anthropology, history, music, and philosophy. These surgical champions sought solitude to reach their goals and gain greater insight in other significant extrasurgical endeavors.

My advice to the young and the seasoned surgeon and/or surgical investigator would be for you to cultivate the state of solitude in a way that will enhance your creative powers as an individual and as a professional. Reserve time at least once a week, from 2 to 4 hours of complete isolation and complete solitude. Create a plan that focuses on your interests. Evolve this plan with a well-established strategy. Do not compromise in pursuing these efforts until you visualize the clear advantage of continuing with these focused, isolated sessions. These sessions will nurture your soul and offer the greatest opportunity for succeeding in life as a professional and as an individual. Speed ahead and do well!

References

1. http://www.quotegarden.com/solitude.html
2. Toledo-Pereyra LH. Maestros de la Cirugia Moderna. Mexico City: Editorial Fondo de Cultura Economica, 1996.
3. Toledo-Pereyra LH. Maestros de la Cirugia Contemporanea. Mexico City: JGH Editores, 1999.
4. Carrel A. Man, the Unknown. New York: Harper and Brothers, 1935.
5. Zimmerman LM. Great Ideas in the History of Surgery. New York: Dover, 1967.

Chapter 51

The Invention of the NIH

Luis H. Toledo-Pereyra

No other title describes better the extraordinary development of the pristine organization that in time would be named the National Institutes of Health (NIH). The NIH represents pure American pride and ingenuity. Victoria Harden, in her well-researched biography of the NIH,[1] pointed out a remark of Robert Bock from the American Societies of Experimental Biology in a newsletter to Representative HenryWaxman: "If we did not have NIH we would have to invent it."[2] Indeed, how truthful that statement has become, particularly as we recognize the great accomplishments of the NIHfor the country and the world as a whole. Scarcely anybody would have believed that the oneroom Hygienic Laboratory established in the Marine Hospital Service at Staten Island, New York, in 1887, with a budget of $300, would have reached the pinnacle that we are witnessing today. The NIH, which was officially recognized in 1948, had a gigantic budget of over $20 billion in 2001, with 75 buildings, 300 acres, and 27 institutes and centers under its tutelage. It is an invention difficult to surpass, and one that represents the commitment and dedication of the American spirit and determination. The combination of competence and resources makes this unique organization one of incredible value to the nation and its citizens.

The NIH mission is to decipher the new scientific principles associated with better knowledge to improve the health of all Americans. The institutes reach their mission by conducting research in their own facilities, supporting research off campus, training research investigators, and improving the communication of medical information.[3] The aim of NIH research is to heighten the possibility of acquiring new and fundamental discoveries that will help the American enterprise. Approximately 10% of the budget goes to intramural research and 80% to extramural funding, with the rest allocated to the various centers and administrative operations.

If one measures the true accomplishments of a university or scientific biomedical organization by the number of investigators that obtained the Nobel distinction through a certain period of time, one has to recognize that NIH has absolutely no competitor in this arena. In fact, during the period 1939-2000 there have been roughly 100 scientists that have secured the Nobel Prize with direct NIH support, of whom five made their discoveries in NIH laboratories.[3] As incredible as this feat may be, one has to praise also Congress and the American people for their dedicated support of this absolutely amazing adventure.

Nearly 50,000 principal investigators are currently being supported with NIH extramural resources to study undetermined areas of medical wonder. About 15,000 employees are on the NIH payroll, and 38,000 research and training applications are reviewed annually through the NIH peer review system.[3] The NIH peer review

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

system is a unique and well-organized one that uses a group of scientific experts to evaluate the merit of each proposal. In this way, NIH maintains the highest standards of academic excellence.

Since its inception, NIH has played a critical role in the medical achievements of our time. The NIH has contributed to significant progress in heart disease, stroke, cancer, spinal-cord injury, respiratory distress syndrome, depression, infectious diseases, and recently gene therapy. In spite of all the essential discoveries already made and all the enormous strides already taken, there is still a long road ahead in the intricate world of medical pathology. Currently, the NIH is poised to advance knowledge in the management and treatment of cancer, heart disease, stroke, Alzheimer's disease, diabetes, arthritis, kidney diseases, mental disorders, drug abuse, alcoholism, AIDS, and other unreachable medical problems.

In conclusion, and reflecting upon the information already conveyed, we as surgical investigators need to recognize the best ways to partner with NIH in the study of the fundamental problems of health-related issues. How can we maximize the opportunities presented by NIH? How can we utilize all available resources to gather the best information for our research and clinical practice? How can we enter the NIH doors as outside collaborators with these excellent institutions? These and other questions need to be considered within the framework of our experimental, academic, or private practice conditions. Surgical researchers are long overdue in tapping the great and unique opportunities that the NIH offers to all investigators in biomedical sciences in the United States.

References

1. Harden VA. Inventing the NIH. Federal Biomedical Research Policy, 1887-1937. Baltimore: Johns Hopkins University Press, 1986.
2. Bock RM. Newsletter toWaxman, HA. Public Affairs 1980; 39(5):ii.
3. www.nih.gov/about/NIHoverview.html

Chapter 52

Passion for Surgical Research

Luis H. Toledo-Pereyra

Without passion, a successful career in surgical research is almost unimaginable.As a good dictionary would indicate, passion is intense desire, dedicated fervor, and powerful ardor to conquer a particular activity in life. Passion is also great enthusiasm and uncontrollable zeal to excel. Passion suffuses accomplishment, success, improvement, advancement, and all the other attributes of progress. Passion demands our full giving but returns fruits in plenty. In many ways, the discipline of surgical research is not different from regular life. The surgical investigator needs to build up, encourage, and maintain all the important characteristics of passion. Without passion, surgical research loses its focus on the highest standards of academics and scholarship.

As researchers, we need to teach students and colleagues the enormous benefits of a passionate life, the noble mission of discovering with oriented purpose. Time in the surgical research laboratory should represent the finest time of each day. Entering a laboratory without passion is like diagnosing without a history and physical, performing surgery without a knife, or writing a novel without a plot. Passion drives experimentation, planning, and the pursuit of truth. And passion perpetuates more passion.

Passion has been the immediate source of discipline and methodical exploration in the lives of great scientific surgeons.[1] Consider the contributions of these renowned surgeon researchers: John Hunter (1728-1793) to experimental surgery, Joseph Lister (1827-1912) to antiseptic surgery, William Halsted (1852-1922) to surgical residency, Harvey Cushing (1869-1939) to brain surgery, Evarts Graham (1882-1957) to pulmonary oncology, and C. Walton Lillehei (1918-1999) to open-heart surgery. Could they have succeeded without their intense passion?

In pursuing surgical research, we should ask, "Is it possible to teach passion to our young residents and faculty?" At first the answer may not be evident. Yet we can reply in the affirmative by remembering that passion can be learned through daily exposure and the continuous example of surgeon masters. Passion grows in the research laboratory that exudes passion and exemplary work. Passion reaches others when there are tangible benefits from its practice. Passion translates into practice when the institution's leaders, surgery unit directors, and staff thrive on the daily opportunities to foster passion in their specialty and research.

Passion is among the significant factors advancing surgical research, for passion fuels the great advances associated with our discipline. Without passion we discover little worth our consideration. Passion, directed appropriately, consummates the marriage between knowledge and intuition, between patience and aggression,

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

between understanding and leadership. Passion ignites the whole operation, elevating the enterprise to new triumphs.

The importance of passion—in all the arts and sciences—has been recognized and used to improve endeavors and motivate individuals to fulfill their highest potential. Pursue discovery, act passionately, and judge prudently—this would be my advice to scientists entering the prestigious doors of surgical research.

References

1. Toledo-Pereyra LH. Discovery in surgical investigation: The essence of Charles Brenton Huggins. J Invest Surg 2001; 14:251.

Chapter 53

Intellectual Honesty

Luis H. Toledo-Pereyra

In the scientific and academic world we praise ourselves for intellectual honesty, recognizing that it is the primary ingredient of a successful and continuous advancement in the general and biomedical sciences. The practice of intellectual honesty has also been perennially supported and frequently examined by our peers in a way that generates credibility with the public. Intellectual honesty assures people that they can believe in the scientific process and trust the truth of the results. Without that truth and the public's trust, we cannot maintain the structures that support scientific inquiry. Let us persist in protecting the truth at all cost, in defending the integrity of research, and in protecting the trust placed in us by the public.

The romantic English poet and philosopher Samuel Taylor Coleridge clearly described how truth and facts interact:

> *Facts are not truths. They are not conclus ions; they are not even premises. The truth depends on, and is only arrived at, by a legitimate deduction from all the facts which are truly material.*

We can drawsome principles fromthis exceptional thought[1] that apply to the practice of the best surgical research sciences.

In a recent article published in the *Wall Street Journal*,[2] Mark Lewis, staff writer for *Forbes*, criticized the case of the noted 20th-century historian, Stephen Ambrose, who "incorporated several phrases and passages from a source without using quotation marks." At stake is the charge of plagiarism, an extraordinarily important negative behavior in any intellectual endeavor. Scientific research is not different in this respect from popular or academic history. Therefore, we need to be keenly aware of circumstances in which our intellectual honesty is put to the test. Without intellectual honesty, the basis for academic and scientific progress is eliminated.

Intellectual honesty in research starts with the creative process itself and advances to the review of the literature, followed by the experimental design and execution of the project, with subsequent collection of the data and ultimate publication. Each one of these steps constantly requires intellectual honesty. Lapses in any step threaten the integrity of the results.

Another aspect of intellectual honesty applies to the reporting of the literature. I am not a moralist, but I am appalled by bibliographic negligence or citation amnesia, as Garfield[3] has so accurately labeled this problem. Why do some very distinguished scientists decide to omit important relevant sources in their publications? Of course, they never miss their own publications or those associated with friends or related groups.

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

Deliberate disregard for the literature is a serious offense, equivalent to intellectual dishonesty. While not so evident at first glance, bibliographic negligence is clearly demonstrable by experts. I fully agree with Garfield,[4] who says:

> *There will never be a perfect solution to the problem of acknowledging intellectual debts. But a beginning can be made if journal editors will demand a signed pledge from authors that they have searched Medline, Science Citation Index or other appropriate print and electronic databases.*

In the *Journal of Investigative Surgery,* we responded to Garfield's call and committed ourselves to solving this problem by requesting, starting with our next issue, that authors sign a pledge that a literature citation index has been consulted before paper submission. Furthermore, our editorial office will conduct its own literature citation analysis to help authors in the process of demonstrating completeness. We will also require that when the pledge is signed, the years reviewed be indicated. We hope that other editors will follow through in this important consideration for establishing bibliographic compliance, which is an integral part of intellectual honesty.

As educators, we must also teach our students, residents, and fellows about the significance of the intellectual process, about being honest, complete, and straightforward in attaining the facts. We deal in the only currency of science and academia, which is truth, integrity, credibility, and honesty. Without these principles, we will fail to advance and expand the sciences in the future.

References

1. J Am Med Assoc 2002; 287(4):480.
2. Lewis M. Do not indict popular history. Wall Street Journal 2002; A20.
3. Garfield E. From citation to bibliographic plagiarism. Curr Contents 1980; 23:5-9.
4. Garfield E. Demand citation vigilance. Scientist 2002; 16:6.

Conclusion

At this point in your reading, you have reviewed the accomplishments and great developments of some surgical giants of this discipline. You have evaluated some philosophical aspects of the surgeon's life as well. You are now in position to judge their contributions to the field and their impact on the world of medicine.

This book presents a glimpse of how surgery evolved through the years, how some of its important representatives responded to the challenges of science and life in general, how their teachings can offer insights and guidance into our way of thinking in our own daily medical practice.

As we present these stories, we would like to leave with the reader the optimism and resourcefulness of these great professionals who represent the best in the surgeon's work and spirit of this medical specialty.

We hope you share with and encourage in future generations of students, residents, and surgical staff an interest and curiosity for understanding those who were at the beginning of this great medical undertaking in the field of surgery and can appreciate the meaning of their achievements.

Luis H. Toledo-Pereyra
Editor

Vignettes on Surgery, History and Humanities, edited by Luis H. Toledo-Pereyra.

LANDES BIOSCIENCE *Vademecum*

Table of contents (excerpt)

The Vademecum series includes subjects generally not covered in other handbook series, especially many technology-driven topics that reflect the increasing influence of technology in clinical medicine.

The name chosen for this comprehensive medical handbook series is Vademecum, a Latin word that roughly means "to carry along". In the Middle Ages, traveling clerics carried pocket-sized books, excerpts of the carefully transcribed canons, known as Vademecum. In the 19th century a medical publisher in Germany, Samuel Karger, called a series of portable medical books Vademecum.

The Landes Bioscience Vademecum books are intended to be used both in the training of physicians and the care of patients, by medical students, medical house staff and practicing physicians. We hope you will find them a valuable resource.

All titles available at

www.landesbioscience.com

ISBN 1-57059-657-3

9 781570 596575

LANDES BIOSCIENCE

Vademecum

Vignettes on Surgery, History and Humanities

Toledo-Pereyra