BROWN-SÉQUARD
Brown-Séquard

An Improbable Genius Who Transformed Medicine

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This book is dedicated to my father, Abraham S. Aminoff, who died in 1994. He is remembered with love, respect, and admiration. It is also dedicated to Jan, my wife and companion for more than thirty-four years, and to our three children—Alexandra, Jonathan, and Anthony—who have given me much happiness and of whom I am so proud.
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Preface

The face of medicine was changed forever by the experimental observations of Charles Edouard Brown-Séquard, a man whose name came to be known widely throughout the centers of learning in the Old World and the New in the latter half of the nineteenth century. Without benefit of family connections or personal wealth, the young Mauritian, who studied medicine in Paris, led an improbable life as an experimenter and academic clinician. He rose to the very top of his chosen profession in England, France, and the United States, but then destroyed his reputation by experiments that were widely misinterpreted and misunderstood by the public and many of his professional colleagues, even as they led to a new understanding of biology, a new system of medicine, and new treatments for ancient diseases.

Historians of modern medicine encounter the name of Brown-Séquard in many different contexts, but most people have never heard of him, and he is familiar to physicians only because of the spinal cord disorder named after him. His multifaceted contributions to the biomedical sciences and to clinical medicine have been forgotten or, perhaps, were never truly appreciated. It is therefore worth mentioning just some of them here, so that the reader can begin to see the breadth of his achievements.

Brown-Séquard was the first to show that the adrenal glands, previously regarded as vestigial structures, are essential to life. His work revealed that the nervous system controlled the caliber of blood vessels and enabled blood flow to be directed to different regions of the body as needed. He showed that acute damage to the brain affected the function of the lungs, a disorder (neurogenic pulmonary edema) that may have a fatal outcome. It was many years before the phenomenon was rediscovered by others, and not until one hundred years after his original observations that successful attempts were made
to treat it, based on mechanisms that he had suggested. By irrigating parts of a dead body with fresh or oxygenated blood, he was able to keep them alive for longer, and this work paved the way for the subsequent development of cardiopulmonary bypass and various transplant procedures. His studies on the hibernating behavior of a small tropical mammal are said to have pointed to the eventual use of hypothermia in patients undergoing heart surgery. His conception of the functional processes that regulate how the brain functions and how—through the nervous system and various chemical (hormonal) mechanisms—the organism is able to function as a seamlessly integrated unit are now generally accepted, but were not well received when first he made his views known. He did not accept the concept, emerging in the latter half of the nineteenth century, that specific functions were localized to anatomically distinct regions of the brain. Instead, he believed that functionally specialized networks of nerve cells were distributed throughout different brain regions, a view that has only recently reemerged, a century later, and is not without merit. His views on the basis of sleep were widely accepted for years although they are remembered no longer. His work on rigor mortis—more than one hundred and fifty years ago—still has major implications for forensic pathologists trying to establish the time of death of their unfortunate subjects. Brown-Séquard’s studies on the cause of bed sores and on the eyes and ears—long forgotten—led to important clinical or scientific advances. But it was his work on the central pathways mediating pain sensation that brought him recognition and reward, and his conclusions still serve as a cornerstone of modern teaching in neurobiology. Interestingly, he subsequently revised his beliefs to suggest that dynamic mechanisms within the spinal cord account, at least in part, for the alterations in sensation that result from spinal cord lesions, and only recently—more than one hundred years later—have neuroscientists come round to a point of view not far removed from that which he described just a few months before he died.

In the last years of his life Brown-Séquard faced ruin, both financial and professional, by his work on organ extracts. It began when he injected himself with the mashed-up testicles of various animals and reported improvement in his general condition. He had come to believe that the testicles manufacture a substance that passes into the blood and affects other parts of the body, and that the changes that develop in the elderly relate at least in part to a decline in function of the genital glands. His report caused a sensation and an uproar. It led to disbelief and outrage, but held the attention of the public by its focus on sex, aging, rejuvenation, and the seemingly bizarre use of extracts of animal testicles. The work led directly to a new therapeutic method—hormone replacement therapy—that initially involved the administration of extracts of
organs, selected on the basis of the disease to be treated, to restore to the
elements that he thought were lacking.

A number of biographical essays that briefly catalogue the main events and
achievements of Brown-Séquard’s life have been published in scholarly jour-
nals over the years. These are generally based on secondary sources, however,
and—to my knowledge—there have been only two full-length English-
language biographies of Brown-Séquard, one by J.M.D. Olmsted and the other
by myself. Both of those books, which were written for a somewhat special-
ized audience, have long been out of print and command unreasonable sums
on the few occasions that copies become available from various web-based
book outlets. The present volume is intended to be an easily accessible biogra-
phy that brings the life and work of Brown-Séquard to a wider audience than
my earlier monograph, and it is written from a somewhat different perspec-
tive, even as it draws from and builds on that earlier work. Indeed, I hope it
will appeal not only to neurologists, neurosurgeons, and neuroscientists but
also to experimental and clinical endocrinologists, general physicians and sur-
geons, those interested in the history of medicine and science, and a segment
of the lay public. More general information is provided than in my earlier
work, including details of important contemporaries, institutions, concepts of
disease, beliefs, and customs, and new archival material, especially from Paris
and the United States, is included.

To write about such a colorful man—who for a time was the popular face
of science—was daunting, if only because original information concerning
him is to be found on both sides of the English Channel, in the New World as
well as the Old, and in the distant land of Mauritius, his birthplace. There
remain gaps in the account of his private life, but I suspect that little is lost, for
his life was his work. The sheer volume of work put out by this prodigious and
enthusiastic investigator, whose interests spanned so many fields, and the
vagaries and eccentricities of his private life, also made it challenging to docu-
ment his life. He had three wives, fathered three children, and founded three
journals, and he was a founder physician of the leading neurological hospital
in England, the first professor of neurology in the world, and the holder of
chairs at Harvard College, the Collège de France, and other prestigious institu-
tions. He was offered several other chairs throughout his remarkable career,
and was an elected member of the three leading scientific societies in the
world, namely the Royal Society (England), the National Academy of Sciences
(USA), and the Académie des Sciences (France). He spent some six years of his
restless life at sea, and his larger-than-life but flawed personality was associated
with a private life as turbulent and troubled as his professional life was erratic. He
managed to bring on himself the enmity of the church, the antivivisectionists,
Preface

and much of the medical profession. A man of ideas—indeed, a visionary of science, as I have labeled him elsewhere—he has always been an easy target for professional critics because some of his ideas have failed to stand the test of time. Nevertheless, many of his ideas, important ones, were correct, even though—in some cases—they were based on vague suppositions and supported by incomplete experimental studies. Although they influenced the subsequent course of events, leaving a lasting impression on the face of medicine, Brown-Séquard has never received proper credit as their originator, coming instead to be marginalized. I have tried to examine some of the reasons for this neglect in the pages that follow.

In discussing Brown-Séquard’s scientific contributions, I have endeavored to do so in terms free of medical jargon and have included a glossary of any technical terms that had to be used in the text. I have placed his contributions in the context of the times, but have also discussed subsequent developments in the field to show their relevance to modern concepts. I hope that this has helped the general reader to appreciate the clinical and scientific issues under discussion. Although their scientific validity can be questioned, I have included his somewhat sensational experiments on himself because of their profound implications and because of the advances to which they led.

I have been led to an appreciation of Brown-Séquard by a long career as a clinical neurologist and neurophysiologist, and have come to admire his versatility and foresight even if I have at times come to wonder about the oddities of his life. Today, he should rank as one of the great clinician-scientists of his generation, an unhappy genius who had profound insight and intuition into the mechanisms that allow living organisms to function as an integrated whole.

I have derived enormous pleasure in studying the life and works of Brown-Séquard, even as I have marveled at the extent of his achievements, have been engrossed by the concepts that he advanced, and have wondered at the wild swings in his fortunes over the years. Many of the issues with which he struggled still baffle us, and I hope that readers will find challenging the sometimes wild imaginings of this captain of science.

Michael J. Aminoff
San Francisco, 2010
Acknowledgments

I received help from many people in preparing this book, and welcome the opportunity to express my gratitude to them. I was first introduced to the curious life of Brown-Séquard while working as an intern on the clinical service of the eminent British neurologist, William Gooddy, in the mid-1960s. Dr. Gooddy was a cultured man of enormous charm, and he easily infected me with his enthusiasm and admiration for Brown-Séquard and his achievements. He had traced the surviving members of Brown-Séquard’s family, who still had some of his papers, correspondence, and clinical and scientific notes, and these were subsequently purchased by the Royal College of Physicians of London and placed in their archives.

Mr. Geoffrey Davenport, then librarian at the College, and his assistant Ms. Terry Picton, were most generous, not only in facilitating my access to this archival material but in photocopying the entire collection for me to study at my leisure in California. I have referenced this archival material in the bibliography of various chapters by manuscript number, indicating the source simply as “Archives, Royal College of Physicians, London.”

I am most appreciative for the assistance that I received from the staff of the library at the University of California, San Francisco, and especially from Ms. Azar Khatibi and Mr. Josue Hurtado, as well as from the staff at the Lane Medical Library at Stanford University Medical Center, the Francis A. Countway Library of Medicine in Boston, and the archives of the Académie des Sciences in Paris. Numerous archivists and librarians at other institutions found time to delve into their records on my behalf with regard to specific queries, and I have acknowledged their assistance in the footnotes to the text. I am pleased also to thank Mr. Timothy Underwood and Ms. Sarah Corr at the University of California, San Francisco, for their help.
Working on this book has afforded me great pleasure, not least because of the many discussions I had over the years with friends such as Professors Douglas S. Goodin and Richard K. Olney at the University of California, San Francisco, on various aspects of Brown-Séquard’s experimental work, as well as with friends and colleagues at many other universities and medical schools in this country and abroad. My three children each read portions of the manuscript and offered suggestions for improvement, and I am grateful to them for their assistance. Alexandra is a physician who is specializing in pediatrics, Jonathan is an attorney who works as a deputy Federal Public Defender, and Anthony is a law student. They were thus able to comment on the manuscript from different perspectives than my own, which was particularly helpful. I thank them also for the patience with which they listened as I recounted over the dinner table what I hope were amusing vignettes about Brown-Séquard and his contemporaries. I also thank my wife, Jan, for ensuring that I had the time to work undisturbed on this book and for her love and support.

I am grateful to those who helped me with the artwork for this book. The illustrative material was derived from various sources, as indicated by the credit line that appears in the legends to the figures in the plates. Ms. Kathy Jee made up the diagrams of the anatomy and physiology of the spinal cord that appear in the text, and I greatly appreciate her help. I am also grateful to Mr. Max Morath, the entertainer and an authority on ragtime, for a copy of his production notes and his recording of the song “Brown-Séquard’s Elixir” by Winchell Forbes, which became popular in American music halls soon after Brown-Séquard reported on his work with testicular extracts.

Mr. Craig A. Panner, my editor at the Oxford University Press, never failed to offer me advice, encouragement, and assistance in seeing this volume through to publication, and I greatly appreciated his help and value his continuing friendship. I am also grateful to Ms. Karen Harmon, Ms. Joann Woy, Mr. Viswanath Prasanna, and the production team who guided this book through the publication process with patience, skill, and understanding.
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BROWN-SÉQUARD
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The Death of a Professor

It was April 2, 1894. Monsieur Loewy, president of the Académie des Sciences in Paris, announced to the assembled members that Charles Edouard Brown-Séquard had died a few hours earlier. He read out a telegram of condolence from the president of the section of physiology of the International Medical Congress then meeting in Rome, commented briefly on the life and accomplishments of the elderly physician and physiologist who had been professor of medicine at the Collège de France, and—after five minutes—brought the meeting to an end as a sign of mourning and respect. The academicians, having heard rumors of his death, had come in great number to the meeting to show their respect for an illustrious colleague, and they now gathered in the corridors to talk and remember him.

Brown-Séquard’s death—along with that of many other grandees of history—was part of the fabric of a turbulent year, filled with many distractions. Anarchists tried to blow up the Royal Observatory in Greenwich; the First Sino-Japanese war broke out; there was revolution in Sicily and civil unrest in the United States, with strikes and marches by the unemployed on Washington and riots in Cleveland; and President Carnot of France was assassinated and Captain Dreyfus arrested for espionage in a case that was to challenge the very underpinnings of the French Republic. Nevertheless, Brown-Séquard’s death was widely noted in the lay press as well as in the scientific periodicals. Obituaries were published in the leading dailies and weeklies of the time, not only in Paris, London, and New York, but in Budapest, Vienna, and St. Petersburg, and in the obscure local newspapers of other
towns and provinces in the major countries of Europe, as well as in his distant birthplace of Mauritius. All of Europe seemed to have been taken by surprise and to miss him. The entire academic world seemed to mourn him.2

The aging Brown-Séquard had, in fact, been ill for at least a year with phlebitis of the right leg, and he had also been depressed by the death of his third wife, Emma, in January 1894, as they wintered in Nice.3 Indeed, he felt lost without her. Perhaps he should have stayed in the warmth of the south of France, as his friends and collaborators had urged, but he felt the need to return to the metropolitan bustle of the capital and to his second-floor apartment at 19 rue François Premier, and it was there that he died of “cerebral congestion” at 11:30 p.m. on April 1, under the care of his devoted physician, Eugene Dupuy, another Mauritian, who had worked under him as a young medical student and dedicated his doctoral thesis to the older man who had come to regard him as a son:

To my illustrious Master, to him who gave me without reservation the treasures of his heart and mind, C. E. Brown-Séquard.4

Brown-Séquard himself described his last illness in a letter to Dr. Waterhouse, a friend to whom he was related by marriage,5 and an account by Dr. Dupuy provides further information,6 as is described in detail in Chapter 12. At his request, there was no state funeral, no pomp or speeches, no wreaths or symbols on the coffin. He had requested that no religious rites be performed, but a private and simple service was nevertheless held at his home, with an Anglican clergyman officiating and giving a brief eulogy. A magnificent wreath of lilacs, camellias, and roses addressed “To Brown-Séquard, [from] the island of Mauritius” was delivered to his home,7,8 and there were flowers from others, despite his wishes. His body was then conveyed to the cemetery of Montparnasse, where it was interred in the presence of representatives of the Académie des Sciences, the Institut de France, the Collège de France, the Société de Biologie, the governments of France and the island of Mauritius, and his friends and collaborators. The pall bearers were LoewyA and Bertrand (president and permanent secretary, respectively, of the Académie des Sciences), Boissier (administrator of the Collège de France), Dumontpallier (secretary of the Société de Biologie),B the sculptor Prosper d’Epinay (representing

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A Maurice Loewy (1833–1907), astronomer and director of the Paris Observatory, has a crater on the moon named after him.

B Alphonse Dumontpallier (1827–1899), French physician, interested in hypnotism and suggestion.
Mauritius), C and Etienne-Jules Marey D (another of the professors at the Collège). 7–9

Time has not been kind to the memory of Brown-Séquard. His legacy is all but forgotten, save for a neurological disorder named after him. Ironically, he revised his view of this disorder in his later years in favor of a concept of sensation and sensory loss so modern and far-reaching in its implications that, despite its importance, it is poorly understood even by modern neuroscientists. That he is the father of modern experimental endocrinology, the originator of hormone replacement therapy, one of the founding fathers of neurology (the study of the nervous system in health and disease), a pioneer in transplant surgery, the discoverer of the nerves that regulate the caliber of blood vessels and thereby influence the “physics of the circulation,” 10 a champion of translational medicine, and a visionary whose ideas spawned a new system of medicine is quietly forgotten or, perhaps, never received the wide recognition that it merited. That he stimulated research and scientific investigation, and a scientific approach to clinical medicine wherever he worked or visited—whether in London, Paris, Boston, New York, Richmond (Virginia), Glasgow, Geneva—and generated an enthusiasm for pure science that he passed on to all with whom he came into contact has rarely been acknowledged, although a number of his contemporaries have attributed their subsequent success to his example.

Brown-Séquard was an eccentric whose background and lifestyle doubtless contributed to his decline into obscurity. He was a colonial, without connections or influence, who reached out to the academic world and achieved great stature but remained always an outsider. Contemptuous of money, he could not be induced by unrestrained offers to take on responsibilities that had no appeal or for which he felt unqualified. He refused to profit from the organotherapy that he developed, instead making his organ extracts available freely to physicians requesting them and publishing the technical details of his approach so that others could follow the methode séquardienne (and personally profited by it). He rejected fashionable medical practices in the Old World and

C Prosper d’Epinay (1836–1914), son of a Mauritian politician, was a well-known sculptor, among whose subjects were King Edward VII, Queen Alexandra, other royalty, and many illustrious personalities of the age. He lived in London, Paris, Rome, and Mauritius. Many famous museums, including the Hermitage, display his works.

D Etienne-Jules Marey (1830–1904), scientist renown for the development of measurement devices for physiological studies and a pioneer in the developing field of cinematography. He was interested in movement and, among his other achievements, showed photographically that a galloping horse has all four hooves off the ground at once.