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ROSEN'S

EMERGENCY MEDICINE

Concepts and Clinical Practice

8th Edition

Volume

2

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ROSEN'S EMERGENCY MEDICINE Concepts and Clinical Practice

Volume 2

8th EDITION

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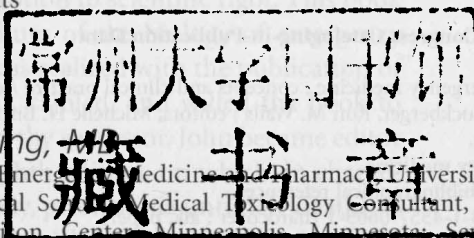
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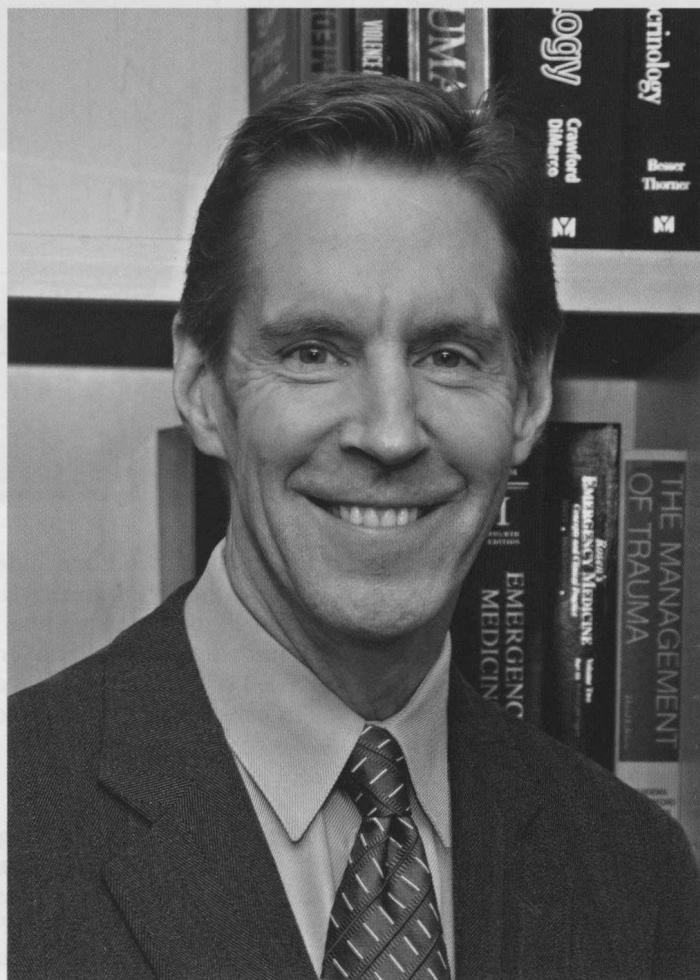
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We, the authors and editors, dedicate this edition of *Rosen's Emergency Medicine: Concepts and Clinical Practice* to our late, beloved colleague, John Andrew Marx, who died suddenly and unexpectedly in his sleep on July 1, 2012. The loss of John, as mentor, friend, colleague, and leader, has left an enormous void in our lives and in the lives of countless others in our field who were inspired or counseled by his incisive intellect and sedulous devotion to scientific rigor. This book was born in 1983, when Peter Rosen's dream of a compendium of the biology of emergency medicine, written by those who study, teach, and practice it, was realized with the publication of the first edition. For three subsequent editions, Peter guided, cajoled, and willed the book to completion, all the while grooming John as his obvious and worthy successor. John became editor in chief for the fifth edition and remained so through this eighth edition, on which, in characteristic fashion, he had discharged his duties fully and flawlessly, prior to his untimely death. As editors, we are proud to have shared this vision, Peter's vision, which became John's vision, with one of the most influential and inspiring physicians of our time. Although he did not live to hold a bound copy in his hands, John guided every aspect of this book from beginning to end, and we know that he was particularly proud that, with this edition, he had served as editor in chief for as many iterations of the book as had Peter and that he felt a sense of completeness and of the inevitability of a timeless legacy on reaching that milestone. Although John achieved professional success beyond description and received virtually every conceivable honor and recognition, including the highest awards from each of our three major societies, he remained a humble, devoted emergency physician, deeply rooted in his love for his patients and for his colleagues and trainees. He was endlessly proud of his children, Shelby and Connor, whom he loved without bound, and who were his favorite topic of conversation. He was inspired, supported, and nurtured by his wife, Karin, with whom he was deeply in love, and from whom he received the gifts of extraordinary happiness and peace. We both are humbled and honored to be able to set these final few words to paper and to gently convey this great work to posterity on behalf of our dear friend and beloved editor, John Andrew Marx.

Ron M. Walls
Robert S. Hockberger
2012

ACKNOWLEDGMENTS

To John, for his friendship, leadership, and unwavering commitment to our specialty; to Ron, for his friendship, vision, and ability to make hard work fun; to our editors, for their dedication, insights, and ability to get it all done “on time and under budget”; to Stefanie and Dee, for their vigilance and support; to Peter, for the leadership, mentorship, and opportunities he provided us all; and to Patty, the love of my life.

RSB

With affection, admiration, and gratitude to Barb, and to our children, Andrew, Blake, and Alexa, whom together we recognize as the most meaningful and priceless gifts we have been privileged to receive. With humble thanks to Peter Rosen, whose selfless commitment to our specialty and to us, as individuals, helped define an entirely new direction in modern medicine. To my hero, John Marx, whose incandescent brilliance changed the trajectory of my career, and to Bob Hockberger, for his consummate professionalism and skill. To our authors and editors, who are the real artists of this creation, and, finally, to my extraordinary faculty and residents at Brigham and Women’s Hospital, whose intellectual curiosity and boundless intelligence inspire me to be better.

RMW

To my family, friends, students, and teachers, who have constantly provided encouragement and support. To the leadership of our specialty, especially John Marx, for the hard work and devotion that have advanced the care of emergency patients everywhere.

MHB

When Peter invited me on board in 1995 for edition four, it felt exhilarating, kind of like being called by Osler (in baritone). I reread his preface to the first edition, which was dedicated to all of our founding colleagues in emergency medicine “who have accepted its responsibilities, challenges, and excitements.” Joanna observes that our daughters, now just married, were 12 and

10—girls do grow quicker than books. Emergency medicine has sure come a long way. Thanks Peter; we all owe you one.

DFD

I dedicate this book to Dr. John Marx, one of our nation’s brightest leaders in emergency medicine, a respected colleague and friend, and to my family for their love and support.

MGH

To Silvana, my wife and closest colleague, who gives me inspiration and keeps me focused on the important things in life. To John, a great mentor and friend who will be missed beyond words.

ASJ

To the emergency medicine faculty and residents at Hennepin County Medical Center and all that we have learned together. To John Marx, a specially gifted teacher and leader, who had a mischievous streak but who could get it done. I am grateful to all the authors who have generously shared their time, energy, and wisdom and to my fellow editors for their commitment to this terrific book. Special thanks to Eric, who should read this book, and to Ali, Amanda, and Beth, for their patience, understanding, and love.

LJL

Thank you to my colleagues, mentors, and friends and particularly thanks to John Marx, who has been all of these for the past 20 years. His gentle guidance and quick wit will be sorely missed.

EJN

To my mother, Audrey Zink, for instilling in me a love of academics and for working so hard to advance her children, against many odds. To John Marx, whose legacy includes this tome and a generation of grateful emergency physicians.

BJZ

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With heavy hearts, we commend to you this comprehensive resource for the high-quality, clarity of emergency medicine. We are forever grateful to the benefit of working with not one, but many extraordinary talents who departed after the This edition marks the final stage in the vision of a highly authoritative and practical clinical reference for all students, devotees, and on the great success of the seventh edition of our chapter formatting, prose, and gently to balance appropriate citation presented against the prospect of a seeking always to reduce redundancy, authoritative background.

Recommendations are based on the best evidence in the absence of clear scientific support for a single action, on the collective experience and judgment of our and editors. This edition is more richly illustrated than it, both to enhance readability and to improve our effectiveness conveying key information in the best possible format. Emergency medicine is increasingly a procedure-based specialty, but we continue to leave the detailed description of procedures to other works, focusing instead on the substantial basis of knowledge, experience, and reasoning that is necessary to achieve the highest possible levels of clinical performance. We have updated and enriched the Continuing Medical Education questions that relate to each chapter, to assist the reader both in learning and in meeting regulatory requirements. We have provided, and will continue to provide online updates, between editions, recognizing that new information flows without regard to publishing schedules, continuously complementing the comprehensive base we have provided.

A book, in the beginning, middle, and end, is about the people who make it happen. We are deeply indebted to our authors and

ment. Their expertise, creativity, and dedication contributed to the book, allowing us to develop and share its rich content. We are grateful, also, to Dr. Barry Brenner and Dr. Michael each of whom meticulously read the entire seventh edition, providing literally dozens of suggestions for improvement, which we have incorporated into edition eight. On behalf of John, we thank Tricia Wyatt, his dedicated, long-serving assistant, whose heart we know aches as do our own. We also thank Diane Pugh and Janice Bingham (RMW) and Maria Figueroa (RSH), for without their extraordinary organizational talent and attention to detail, we would most certainly be lost. Finally, we have to thank, one final time, our beloved John, with the sadness that this is our final project together, but with the joy of having shared so much, for so long.

Ron M. Walls, MD
Robert S. Heckberger, MD
2012

PREFACE TO THE EIGHTH EDITION

With heavy hearts, we commend to you the eighth edition of this comprehensive resource for the biology and practice of the specialty of emergency medicine. We are fortunate to have had the benefit of working with not one, but two iconic editors in chief. This edition marks the final stage in the evolution of John Marx's vision of a highly authoritative and pithy, timely and timeless, clinical reference for all students, devotees, and practitioners of this most honorable of the medical specialties. This edition builds on the great success of the seventh edition, with further refinement of our chapter formatting, prose, and citations. We worked diligently to balance appropriate citation support for the material presented against the prospect of a bewildering sea of references, seeking always to reduce redundancy, while providing timely and authoritative background.

Recommendations are based on the best evidence available and, in the absence of clear scientific support for a single course of action, on the collective experience and judgment of our authors and editors. This edition is more richly illustrated than any before it, both to enhance readability and to improve our effectiveness in conveying key information in the best possible format. Emergency medicine is increasingly a procedure-based specialty, but we continue to leave the detailed description of procedures to other works, focusing instead on the substantial basis of knowledge, experience, and reasoning that is necessary to achieve the highest possible levels of clinical performance. We have updated and enriched the Continuing Medical Education questions that relate to each chapter, to assist the reader both in learning and in meeting regulatory requirements. We have provided, and will continue to provide online updates, between editions, recognizing that new information flows without regard to publishing schedules, continuously complementing the comprehensive base we have provided.

A book, in the beginning, middle, and end, is about the people who make it happen. We are deeply indebted to our authors and

to our editors, whose names you see on the cover and title page. We bid a fond farewell, with endless gratitude, to Jim Adams and Bill Barsan, editors of extraordinary talent who departed after the seventh edition, finally succumbing to the overwhelming demands for their time and talents. We were fortunate to recruit Brian Zink and Andy Jagoda to our cause, and it was clear within weeks that we had made the right choice, with each taking the reins as if seasoned by multiple prior editions. Our other editors, veterans all, embraced their new colleagues, and we had an extraordinary unity of purpose as we moved relentlessly toward our shared vision. We are grateful also to our skilled, patient, and brilliant publishing team at Elsevier: Judy Fletcher, our global content development director; Stefanie Jewell-Thomas, our senior content strategist; and Deidre (Dee) Simpson, our senior content development specialist. Their expertise, creativity, and dedication contribute much to the book, allowing us to develop and share its rich content. We are grateful, also, to Dr. Barry Brenner and Dr. Michael Richardson, each of whom meticulously read the entire seventh edition, providing literally dozens of suggestions for improvement, which we have incorporated into edition eight. On behalf of John, we thank Tricia Wyatt, his dedicated, long-serving assistant, whose heart we know aches as do our own. We also thank Diane Pugh and Janice Bingham (RMW) and Maria Figueroa (RSH), for without their extraordinary organizational talent and attention to detail, we would most certainly be lost. Finally, we have to thank, one final time, our beloved John, with the sadness that this is our final project together, but with the joy of having shared so much, for so long.

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How This Medical Textbook Should Be Viewed by the Practicing Clinician and the Judicial System

The editors and authors of this textbook strongly believe that the complex practice of medicine, the vagaries of human diseases, the unpredictability of pathologic conditions, and the functions, dysfunctions, and responses of the human body cannot be defined, explained, or rigidly categorized by any written document. *Therefore, it is neither the purpose nor intent of our textbook to serve as an authoritative source on any medical condition, treatment plan, or clinical intervention, nor should our textbook be used to rigorously define a standard of care that should be practiced by all clinicians.*

Our written word provides the physician with a literature-referenced database, and a reasonable clinical guide that is combined with practical suggestions from individual experienced practitioners. We offer a general reference source and clinical roadmap on a variety of conditions and procedures that may confront clinicians who are experienced in emergency medicine practice. This text cannot replace physician judgment; cannot describe every possible aberration, nuance, clinical scenario, or presentation; and cannot define rigid standards for clinical actions or procedures. *Every medical encounter must be individualized, and every patient must be approached on a case-by-case basis.* No complex medical interaction can possibly be reduced to the written word. The treatments, procedures, and medical conditions described in this textbook do not constitute the total expertise or knowledge base expected to be possessed by all clinicians. Finally, many of the described complications and adverse outcomes associated with implementing or withholding complex medical and surgical interventions may occur, even when every aspect of the intervention has been standard or performed correctly.

The editors and authors of *Rosen's Emergency Medicine: Concepts and Clinical Practice, 8th Edition*

From Roberts JR, Marx JA: *Position Statement: Use of Medical Textbooks in Malpractice Claims*, *Emerg Med News*, Vol. XXXI, 2:3, February 2009.

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