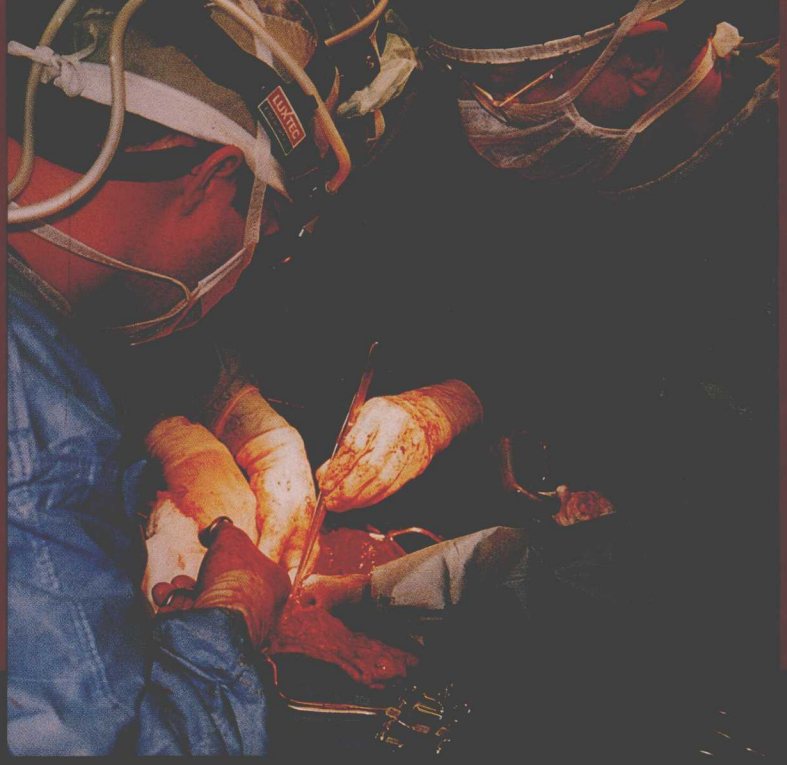

TRAUMA

SIXTH EDITION

DAVID V. FELICIANO

KENNETH L. MATTOX

ERNEST E. MOORE

TRAUMA

Sixth Edition

EDITORS

DAVID V. FELICIANO, MD
Professor of Surgery
Emory University School of Medicine
Chief of Surgery
Grady Memorial Hospital
Atlanta, Georgia

KENNETH L. MATTOX, MD
Professor and Vice Chairman
Department of Surgery
Baylor College of Medicine
Chief of Staff
Chief of Surgery
Ben Taub General Hospital
Houston, Texas

ERNEST E. MOORE, MD
Professor and Vice Chairman, Department of Surgery
University of Colorado at Denver and Health Sciences Center
Bruce M. Rockwell Distinguished Chair of Trauma Surgery
Rocky Mountain Regional Trauma Center
Chief of Surgery
Denver Health Medical Center
Denver, Colorado

New York Chicago San Francisco Lisbon London Madrid Mexico City
Milan New Delhi San Juan Seoul Singapore Sydney Toronto

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Foreword

The emerging new millennium has unveiled awe-inspiring breakthroughs in many domains. The Gordian knot of the genome has been severed, thus releasing a continuous stream of discoveries about our inner being. Technology has exploded as typified by ubiquitous, unwired communications, widespread use of industrial robots, cloning, and the marvelous exploration of interplanetary space. The field of medicine has shared in this modern industrial and technological revolution. Among the many examples of this expansion are the availability of highly accurate and more detailed magnetic resonance imaging, ultrasonography, and computed tomography, genetic engineering, and the application of robotic technology to the surgeons' armamentarium.

Many strategies for injury prevention have been developed in the new millennium, as well. The automotive industry has introduced assisted braking sensors, blind spot sensors, and improved restraint and airbag systems. Engineering creations, such as front distance sensors, will allow cars to be propelled along highways with greatly enhanced warning systems. The Occupational Safety and Health Administration has increased the protection of workers. The medical industry is expanding safety goals to prevent injury to patients and physicians with multiple innovations including retractable scalpels. Great advances are being made at reducing recidivism in our injured population. Screening and brief intervention programs are being applied more frequently for patients under the influence of alcohol or illicit substances, and these approaches should show much benefit in the near future.

With all of the progress made in the prevention of injury and reduced recidivism, why do we need this Sixth Edition? Sadly, the examples of man's inhumanity to man have kept pace with the recent gains in science, technology, medicine, prevention of injury, and patient reeducation. Drivers routinely push their vehicles beyond the limits of safety. This carelessness of course, is exaggerated when under the influence of alcohol or other substances. Motorcyclists persist in their efforts to have our legislative bodies repeal helmet laws. Our citizenry continues to resolve minor disputes with knives and guns in both our large cities and in our so-called peaceful suburbs. The world community has incorporated the scientific advances in weaponry into conflicts on the battlefields, which are often in the middle of large cities. A new technique for creating injury to innocent citizens, namely, the suicidal terroristic act, has created great havoc. More mass catastrophes, such as occurred at the World Trade Center, are waiting to occur. Injury will continue to be the number one cause of death and disability in young people throughout the world. And, the ravages of injury will continue to challenge our most experienced physicians in all specialties; hence, this Sixth Edition is truly needed.

This edition follows the format of the prior editions—namely, presenting the most current thinking by the brightest and the best. The text covers trauma from a global perspective with topics including penetrating wounds, blunt injury, gang violence, insect bites and stings, burns and radiation injury, geriatric and pediatric trauma, genetic influences, and the contributive effects of substance abuse. Each author incorporates appropriate historical vignettes and then progresses to the most current thinking regarding prevention, etiology, and definitive management in both the operating room and in the critical care suite. Excellent illustrations augment the written word. The authors pay appropriate respect to the different views of best therapy where there is controversy, but are sure to leave the reader with a compilation of his/her desired approaches to treatment. The complete bibliography that accompanies each chapter directs the reader to the differing opinions regarding the best therapy for each type of injury. The postoperative challenges of multiple organ failure after hemorrhagic shock and sepsis are thoroughly discussed.

The Sixth Edition has added four new topics that are vital to the trauma and acute care surgeon in the 21st century. Two of these new chapters, "Disaster Management" and "Weapons of Mass Destruction", are in response to the increased threat of terrorism and mass casualties. A third new chapter, "Acute Care Surgery," introduces the reader to the role that trauma surgeons will be fulfilling in the near future throughout the world. This chapter identifies the logic and efficiency of having on-call

surgeons provide emergency care for both trauma and non-trauma emergencies. The fourth new chapter, "Gastrointestinal Failure," expands the reader's appreciation of the effects of shock and sepsis on the gut and outlines the optimal skills for providing nutritional support to the patient with multiple organ dysfunction.

This comprehensive text on trauma and its complications is an important treatise, which belongs in the library of all students, residents, and practitioners who care for or wish to be informed about care of the injured patient.

Charles E. Lucas, MD
Professor, Department of Surgery
Wayne State University School of Medicine
Detroit, Michigan

Foreword to the First Edition

Death and taxes are the two most quoted inevitabilities of life; trauma qualifies as a legitimate third. Since trauma is a peculiarly surgical disease, surgeons have an overriding responsibility for the injured patient. From the beginning of what we choose to call civilization, the universal public image of the surgeon has been that of the citizen to whom the injured are brought.

If ever all other surgical disease is conquered, trauma will remain. Sooner or later every citizen is a patient. Whether terrorists endure, urban assassins thrive, conventional warfare flare, or atomic power be unleashed can only be conjectured. We can be certain, however, that the exploring child will tumble, the adventurous adolescent misjudge, the young sportsman overreach, the intoxicated adult crash, and the aged fall. Buildings will burn, vehicles will crash, and tornadoes will destroy.

Inconsistencies abound in our attitudes to trauma. As a nation, we talk about premature birth but little about premature death, even though trauma remains the greatest killer of our citizens between the ages of 1 and 44 years when most productive as breadwinners and parents. We properly stress the vital need for active measures to prevent birth accidents when we remain apathetic about other accidents. We view with horror the intoxicated obstetrician but tolerate the drunken driver. We insist on detailed privileges for individual physicians but not for all institutions that seek to manage injured patients. Our Congress, lobbied by interested scientists and lay persons, grants disproportionately vast sums of money to categorical diseases affecting much smaller numbers of citizens than does trauma. It may perhaps be reasonably argued that those interested in trauma have not stressed their case with sufficient vigor. We protect animals against the guns of hunters but accept with seeming equanimity the shame of the highest homicide rate in the Western World and possibly beyond. We devote public money to sports stadiums while neglecting our emergency medical services. We acquiesce in the repeal of helmet laws while we bemoan the cost of care for the thousands of vegetating humans produced each year by this legislative cowardice condoned in the name of personal freedom. The indictment is long and can be lengthened.

The litany is sad, well known, and widely ignored. Almost 100,000 die from accidents each year and 9 million more sustain disabling injuries. With an increase in the speed limit recently legislated, vehicular deaths will soon exceed 50,000 again and disabling injuries rise to approximately 2 million annually. The cost to the country is estimated at about $100 billion each year with vehicular accidents accounting for half of this. Approximately $25 billion more will be lost in wages, and medical expenses will be about $15 billion. Almost 10% of all hospital discharges will have originated in trauma and about 4 million citizens will be labeled with a capricious DRG that discriminates against the institutions that treat the most severely injured among them. Alcohol will continue to be a factor in more than half the motor vehicle accidents with few attempts made to curb its potential for carnage. Each U.S. citizen will have a 1 in 70 chance of being hospitalized for trauma this year and almost 50% of the male deaths due to trauma will occur in individuals under the age of 34. Two million citizens will be burned, approximately 100,000 hospitalized, and 10,000 will die.

As if inured to the presence of trauma, our society has chosen for the most part-or at least until very recent times-to accept trauma with a passivity reminiscent of that displayed by the ancients toward lightning and the bubonic plague. For the most part, public interest has flared only in times of military or civilian conflict. Over the years, a relatively small group of surgeons has viewed the care of the injured as their primary clinical responsibility while a still smaller cadre have concerned themselves with the scientific and sociologic aspects of the disease. Regrettably, the central governments of the world have conspicuously ignored the problem even when trauma takes the pride of their youth, hobbles their workers, and empties their coffers. Most citizens are sensitized to trauma only when a personal loss is suffered or when a national celebrity falls victim. Even then, the more for reform tends to be fleeting and surgeons and physicians as a group have been slow to fan the embers of heightened sensitivity. As yet, no sustained passion for prevention and cure, as typified by campaigns on cancer and cardiovascular disease, has been generated.

Happily, a perceptible change has occurred over the past 25 years. A sense of urgency is now discernible and a determination

"The First Edition was published in October, 1987."

to improve results is increasingly visible. Today, it is clearly recognized that trauma is a disease that can be identified, measured, and often prevented. The effects of trauma can be ameliorated and lives saved. While the needs of the injured patient have often been obscured by a veil shot through with institutional ambitions, personal gains, professional convenience, and public apathy, many holes have now been made in this fabric, which in some parts of the country has been virtually stripped away. The Committee on Trauma of the American College of Surgeons, aided increasingly by other medical and lay organizations, has been largely responsible for this change as it has sought to elevate the public recognition of trauma of that accorded to other major diseases. While doing this, these groups have stressed organization, efficiency, quality of care, and their individual responsibility of all health professionals involved with the injured patient. It is proper that surgeons should lead in the design of systems to prevent trauma. Surgeons should also lead in the rapid identification of the injured when such systems fail, the implementation of protocols for prehospital transport and care, the organization of hospital staffs and resources to permit optimal care, the collection of data for trauma registries which permit epidemiologic and clinical studies, the design of educational programs for physicians and others, and the pursuit or research whether managerial, fiscal, sociologic, basic, or clinical in nature. Finally, it is proper that surgeons should be deeply concerned with improving the much neglected phase of rehabilitation.

Education merits special comment. Since trauma knows no visceral boundaries and calls forth a profound physiologic response liable to affect every cell and system in the body simultaneously and to varying unpredictable degrees, an essential feature of the training of any surgeon is the ability to recognize priorities as if by instinct. The sequential application of resuscitative interventions should come naturally to any trained surgeon of whatever persuasion. Knowledge of advanced trauma life support skills should be as integral to a surgeon as a knowledge of the importance of sterility at the operating table.

Trauma does not lend itself well nor naturally to intellectual fragmentation. Organs cannot be viewed in isolation. The potential for organ failure-lung, kidney, intestine, cerebrum-originating from an anatomic distant site is omnipresent. The need for imaginative and logical mental projection into the patient's clinical future is therefore axiomatic. While important for all surgical lesions, nowhere is this skill more important than in the care of the acutely injured patient.

To this point, most textbooks, reflecting the rather narrow vision of trauma held by most physicians, have concentrated almost exclusively on the technical aspects of therapy. This volume is possibly the first to attempt to encompass their modern approach to trauma as an integrated, orderly, broad and thoughtful enterprise rather than a relatively crude prosaic venture. This comprehensive array of chapters ranges from the surgeon's inescapable responsibility for promoting the avoidance of trauma to the long neglected social, economic, and rehabilitative facets that we have found so difficult to engage. Samuel Johnson's observation that "man needs more often to be reminded than informed" is belied in the pages that follow as all who care for the injured patient will find much to instruct them. Trauma is the common thread that binds all surgeons together. It remains a stark reminder of our origins and our obligations.

Alexander J. Walt, MB, ChB, MS(Minn),
FRCS(Eng), FRCS(C),
Penberthy Professor and Chairman
Department of Surgery
Wayne State University
Chief of Surgery
Harper-Grace Hospitals
Detroit, Michigan

Preface to the Sixth Edition

Over 22 years ago, the three editors of *TRAUMA* met with the original publishers of the textbook to plan the First Edition. Envisioned as a true, comprehensive reference for all involved with the care of injured patients, the book has continued to evolve over what are now six editions. The philosophy of the editors, however, has remained consistent. First, new chapters are added as the body of knowledge in trauma expands and areas of interest change in the trauma community. Second, the authors of 30-35% of the chapters are changed with each edition to bring new perspectives to a textbook that is published on a regular basis at relatively short intervals.

This Sixth Edition retains the format of previous editions with sections entitled Trauma Overview, Generalized Approaches to the Traumatized Patient, Management of Specific Injuries, Special Problems, and Management of Complications after Trauma. All aspects of trauma, including history, epidemiology, prevention, regionalization, scoring and outcomes, kinematics, prehospital care, response to mass casualties and disasters, rural trauma, evaluation and resuscitation in the emergency department, operative and nonoperative care for specific injuries, management of special problems, and critical care after trauma are discussed. Also, the Sixth Edition includes four new chapters entitled Disaster Management, Weapons of Mass Destruction, Acute Care Surgery, and Gastrointestinal Failure. These are all topics of great interest currently in the worldwide trauma community. In addition, 31% of the chapters now have new authors from new institutions. The authors of the commentaries have been changed from those in the Fifth Edition, as well. The Sixth Edition, therefore, is intended to be an up-to-date and one-stop comprehensive reference source that contains information on the entire continuum of trauma care.

Since the completion of the Fifth Edition, three special colleagues who made significant contributions to prior editions of *TRAUMA* have passed away. This Sixth Edition is dedicated to their memories and is a small token of appreciation for their teaching, friendship, and contributions to *TRAUMA*:

C. James Carrico, MD (1935-2002)-Friend, teacher, leader in the trauma community, renowned academic surgeon, and Role Model in American Surgery

Peter Mucha, Jr., MD (1943-2006)-Mentor, friend, charismatic inspiration to many, Mayo surgeon, and Innovative Leader in Trauma Care

Charles J. Weigel, II, JD (1936-2006)-Friend, teacher and advisor, founder of the South Texas Law Institute for Medical Studies, and Distinguished Professor of Law

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An extraordinary number of individuals contribute to a comprehensive textbook of this size. The Editors are especially grateful for the efforts of the authors of the chapters and commentaries for their willingness to share their knowledge, expertise, and time and ensure that *TRAUMA* remains a standard in the field. Special thanks are extended to Dr. Charles E. Lucas, Professor of Surgery at Wayne State University School of Medicine and surgeon extraordinaire, for writing the Foreword to the Sixth Edition. In addition to mentoring the first editor, he has been a teacher and role model for an entire generation of surgeons who care for injured patients.

We are also indebted to the most tolerant and supportive staff from McGraw-Hill Medical Publishing Division-Marsha S. Loeb, Editor, and Christie Naglieri, Project Development Editor. They have endured delays, excuses, and revisions with remarkable professionalism and patience. We thank them for their commitment to excellence.

TRAUMA could not have been completed without the valiant efforts of our administrative assistants-Chuki King Valentine, Samantha Bucknor, Meg Lewis-Howe (DVF), Mary Allen and Lisa Villarreal(KLM), and Victoria Martin (EEM). They arranged schedules to permit writing and editing, typed manuscripts, communicated with authors and publishers, and coordinated many of the activities necessary to complete this Sixth Edition. We thank them for their many contributions to the textbook and for their friendship and loyalty.

Finally, we thank all of our families, mentors, teachers, friends in the field of trauma, and especially, faculty colleagues and surgical residents from Emory University, Baylor College of Medicine, and the University of Colorado.

David V. Feliciano, MD
Kenneth L. Mattox, MD
Ernest E. Moore, MD

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Contributors

Maria M. Aaron, MD
Associate Professor of Ophthalmology
Residency Program Director
Emory University School of Medicine
Emory Eye Center
Atlanta, Georgia
Chapter 21

Charles A. Adams, Jr., MD
Assistant Professor of Surgery
The Warren Alpert Medical School of Brown University
Providence, Rhode Island
Chapter 49

David H. Ahrenholz, MD
Associate Professor of Surgery
University of Minnesota Medical School
Associate Director
Regions Burn Center
St. Paul, Minnesota
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Jameel Ali, MD
Professor of Surgery
University of Toronto
Chief, Region XII
American College of Surgeons, Committee on Trauma
Toronto, Ontario, Canada
Commentary on Chapter 11

Reginald Alouidar, MD
Fellow
Division of Trauma/Critical Care Surgery
University of Miami Miller School of Medicine
Miami, Florida
Chapter 47

Juan A. Asensio, MD
Professor of Surgery
The New Jersey Medical School
University of Medicine and Dentistry of New Jersey
UMDNJ - University Hospital
Newark, New Jersey
Chapter 28

Dennis W. Ashley, MD
Director of Trauma and Critical Care
Medical Center of Georgia
Professor of Surgery
Mercer University School of Medicine
Macon, Georgia
Commentary on Chapter 13

Philip S. Barie, MD, MBA
Professor of Surgery and Public Health
Chief
Division of Critical Care and Trauma
Director
Anne and Max A. Cohen Surgical Intensive Care Unit
Weill Cornell Medical College
New York, New York
Chapter 19

Robert D. Barraco, MD, MPH
Assistant Professor of Surgery
Penn State College of Medicine
Chief
Geriatric and Pediatric Trauma
Lehigh Valley Hospital
Allentown, Pennsylvania
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Michael B. Shapiro, MD
Associate Professor of Surgery
Northwestern University Feinberg School of Medicine
Medical Director, Surgical Intensive Care Unit
Northwestern Memorial Hospital
Chicago
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Tiffany K. Bee, MD
Assistant Professor of Surgery
University of Tennessee Health Science Center
Memphis, Tennessee
Chapter 32

Walter L. Biffl, MD
Associate Professor of Surgery
Denver Health Medical Center
University of Colorado School of Medicine Denver
Colorado
Chapter 49
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H. Scott Bjerke, MD
Medical Director
Methodist Trauma Service and IPD Swat Medics
Associate Professor of Surgery
Indiana University School of Medicine
Indianapolis, Indiana
Chapter 48
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Ernest F.J. Block, MD, EMT-P
Clinical Associate Professor of Surgery
University of Florida
Orlando Regional Medical Center
Orlando, Florida
Commentary on Chapter 61

Elliot B. Bodfosky, MD
Assistant Professor of Physical Medicine and Rehabilitation
UMDNJ Robert Wood Johnson Medical School
Chief
Department of Physical Medicine and Rehabilitation
UMDNJ Cooper University Hospital
Camden, New Jersey
Chapter 54

Karen J. Brasel, MD, MPH
Associate Professor of Surgery and Health Policy
Medical College of Wisconsin
Milwaukee, Wisconsin
Commentary on Chapter 2

L. D. Britt, MD, MPH
Brichouse Professor and Chairman
Eastern Virginia Medical School,
Norfolk, Virginia
Chapter 23

Geoffrey Broocker, MD
Walthour-DeLaPerriere Professor of Ophthalmology
Emory University School of Medicine
Chief of Service
Department of Ophthalmology
Grady Memorial Hospital
Atlanta, Georgia
Chapter 21

Susan I. Brundage, MD, MPH
Associate Professor of Trauma and Critical Care
Stanford University School of Medicine
Stanford, California
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Jon M. Burch, MD
Professor of Surgery
University of Colorado at Denver and Health Sciences Center
Denver, Colorado
Chapter 35

Tom Burdick, MD
Assistant Professor of Radiology
University of Washington
Harborview Medical Center
Seattle, Washington
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Lisa K. Cannada, MD
Assistant Professor
University of Texas Southwestern Medical Center
Parkland Hospital
Dallas, Texas
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Eddy H. Carrillo, MD
Director of Trauma Services
Memorial Regional Hospital
Hollywood, Florida
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David C. Chang, PhD, MPH, MBA
Assistant Professor of Surgery
Johns Hopkins School of Medicine
Department of Health Policy and Management
Bloomberg School of Public Health
Baltimore, Maryland
Chapter 48

Michael Chang, MD
Professor of General Surgery
Wake Forest University School of Medicine
Director of Trauma/Burn Services
Wake Forest University Health Sciences
Winston-Salem, North Carolina
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David J. Ciesla, MD
Associate Professor, Dept. of Surgery
University of South Florida
Director Division of Trauma and Surgical Critical Care
Tampa General Hospital
2 Columbia Drive G417
Tampa Florida
Chapter 68

William G. Cioffi, MD
Professor and Chairman
Brown Medical School
Surgeon-in-Chief
Rhode Island Hospital
Providence, Rhode Island
Chapter 49

David L. Ciraulo, DO, MPH
Clinical Associate Professor of Surgery
University of Vermont College of Medicine/University of New England College of Osteopathic Medicine
Director
Trauma Outreach and Surgical Emergency Preparedness
Maine Medical Center
Portland, Maine
Chapter 56

Ian Civil, MD, ChB, MB
Director of Trauma Services
Auckland City Hospital
Auckland, Grafton, New Zealand
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Michael Coburn, MD
Associate Professor of Urology
Carlton-Smith Chair in Urologic Education
Vice Chairman for Academic Affairs
Baylor College of Medicine
Chief of Urology
Ben Taub General Hopsital
Houston, Texas
Chapter 39

Raul Coimbra, MD, PhD
Professor of Surgery
Chief
Division of Trauma, Surgical Critical Care, and Burns
University of California, San Diego Medical Center
Chapter 4
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Frederic J. Cole, Jr., MD
Associate, Trauma Director
Legacy Emanuel Hospital and Health Center
Portland, OR
Chapter 23

Edward E. Cornwell, III, MD
Director
Adult Trauma Service
Johns Hopkins University School of Medicine
Baltimore Maryland
Chapter 48
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Robert L. Coscia, MD
Assistant Professor of Surgery
Medical College of Wisconsin
Froedtert Memorial Lutheran Hospital
Milwaukee, Wisconsin
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C. Clay Cothren, MD
Assistant Professor
University of Colorado Health Sciences Center
Attending Surgeon
Denver Health Medical Center
Denver, Colorado
Chapter 15
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H. Gill Cryer, MD, PhD
Professor of Surgery
Chief of Trauma & Critical Care
University of California, Los Angeles
Los Angeles California
Chapter 65

James G. Cushman, MD
Associate Professor of Surgery
University of Maryland School of Medicine
R. Adams Cowley Shock Trauma Center
Baltimore, Maryland
Commentary on Chapter 9

James W. Davis, MD
Associate Professor of Clinical Surgery
University of California, San Francisco - Fresno
Chief of Trauma
University Medical Center
Fresno, California
Chapter 31

Kimberly A. Davis, MD
Associate Professor of Surgery
Chief of the Section of Trauma
Surgical Critical Care and Surgical Emergencies
Yale University School of Medicine
Trauma Director
Yale New Haven Hospital
New Haven, Connecticut
Commentary on Chapter 49

Gerald B. Demarest, MD
Associate Professor of Surgery
Director of Burns and Trauma
University of New Mexico
Albuquerque, New Mexico
Commentary on Chapter 48

Demetrios Demetriades, MD, PhD
Professor of Surgery
University of Southern California, Los Angeles
Director
Division of Trauma/SICU
Los Angeles County & University of Southern California Medical Center
Los Angeles, California
Chapter 30

Christopher J. Dente, MD
Assistant Professor Surgery
Emory University
Associate Director of Trauma
Grady Memorial Hospital
Atlanta, Georgia
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Rochelle A. Dicker, MD
Assistant Professor of Surgery
University of California, San Francisco
San Francisco, California
Chapter 60
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Lawrence N. Diebel, MD
Professor of Surgery
Wayne State University
Detroit, Michigan
Chapter 34

James C. Duke, MD, MBA
Associate Professor of Anesthesiology
University of Colorado Health Sciences Center
Associate Director of Anesthesiology
Denver Health Medical Center
Denver, Colorado
Chapter 18

Chris Dunn, PhD
Associate Professor of Psychiatry and Behavioral Sciences
University of Washington School of Medicine
Harborview Medical Center
Seattle, Washington
Chapter 45

Soumitra R. Eachempati, MD
Associate Professor of Surgery and Public Health
Weill Cornell Medical College
New York, New York
Chapter 19

Alexander L. Eastman, MD
Resident in General Surgery
University of Texas Southwestern Medical Center
Dallas, Texas
Commentary on Chapter 17

Brent Eastman, MD
N. Paul Whittier Chair of Trauma
Scripps Memorial Hospital
La Jolla, California
Chief Medical Officer
Scripps Health
San Diego, California
Commentary on Chapter 37

Babak Eghbalieh, MD
Chief Surgical Resident
University of California, San Francisco
University Medical Center - Fresno
Fresno, California
Chapter 31

A. Peter Ekeh, MD
Associate Professor of Surgery
Boonshoft School of Medicine
Wright State University
Miami Valley Hospital
Dayton, Ohio
Commentary on Chapter 40

Timothy C. Fabian, MD
Harwell Wilson Alumni Professor & Chairman
Department of Surgery
University of Tennessee Health Science Center
Memphis, Tennessee
Chapter 32

Eugen Faist, MD
Professor of Surgery
Ludwig-Maximilians-University
Munich, Germany
Chapter 67

Samir M. Fakhry, MD
Professor of Surgery
Virginia Commonwealth University - Inova Campus
Chief
Trauma and Surgical Critical Care Services
Associate Chair for Research and Education
Department of Surgery
Inova Fairfax Hospital
Falls Church, Virginia
Chapter 61

Sam E. Farish, DMD
Assistant Professor of Oral & Maxillofacial Surgery
Department of Surgery
Emory University School of Medicine
Chief of Oral & Maxillofacial Surgery
Atlanta VA Medical Center
Atlanta, Georgia
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David V. Feliciano, MD
Professor of Surgery
Emory University School of Medicine
Chief of Surgery
Grady Memorial Hospital
Atlanta, Georgia
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Ricardo Ferrada, MD
Professor of Surgery
Universidad del Valle
Cali, Colombia
Commentary on Chapter 25

John Fildes, MD
Professor and Vice Chair of Surgery
University of Nevada School of Medicine
Chief
Division of Trauma and Critical Care
University of Nevada School of Medicine
Las Vegas, Nevada
Commentary on Chapter 5

Lewis Flint, MD
Editor-in Chief
Selected Readings in General Surgery
Division of Education, American College of Surgeons
633 North St. Clair Street
Chicago, Illinois
Commentary on Chapter 38

Raquel M. Forsythe, MD
Assistant Professor of Surgery and Critical Care Medicine
University of Pittsburgh
Pittsburgh, Pennsylvania
Chapter 13

Carolyn J. Fowler, MD
Assistant Professor
Johns Hopkins Bloomberg School of Public Health
Johns Hopkins University School of Nursing
Baltimore, Maryland
Chapter 2

Heidi L. Frankel, MD
Professor of Surgery
University of Texas Southwestern
Dallas, Texas
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Bradley D. Freeman, MD
Associate Professor of Surgery
Washington University School of Medicine
St. Louis, Missouri
Commentary on Chapter 57

Eric R. Frykberg, MD
Professor of Surgery
University of Florida College of Medicine
Chief Division of General Surgery
Shanos Jacksonville Medical Center
Jacksonville, Florida
Chapter 44

Richard L. Gamelli, MD
The Robert J. Freeark Professor and Chairman
Department of Surgery
Chief
Burn Center
Loyola University Medical Center
Director
Burn & Shock Trauma Institute
Professor of Pediatrics
Loyola University Medical Center
Maywood, Illinois
Commentary on Chapter 50

Luis M. García-Núñez, MD
General and Trauma Surgeon
Department of Surgery
Central Military Hospital
National Defense Department
Professor
Military School of Health Professionals
University of Army and Air Force
National Defense Department
Distrito Federal, Mexico
Chapter 28

Jennifer Garza, MD
Resident in Pediatric Surgery
Oklahoma University Health Sciences Center
Oklahoma City, Oklahoma
Chapter 46

Larry M. Gentilello, MD
Professor of Surgery
Division of Burns, Trauma and Critical Care
University of Texas Southwestern Medical School
Dallas, Texas
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David A. Gerber, MD
Associate Professor of Surgery
University of North Carolina at Chapel Hill
Chapel Hill, North Carolina
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