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RICHARD G. ELLENBOGEN  
SALEEM I. ABDULRAUF  
LALIGAM N. SEKHAR

*principles of*  
**Neurological Surgery**

third edition



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Principles of  
**Neurological  
Surgery** **Third Edition**

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*Associate Content Strategist:* Julie Goolsby  
*Content Development Specialist:* Julia Bartz  
*Publishing Services Manager:* Patricia Tannian  
*Senior Project Manager:* Sharon Corell  
*Senior Book Designer:* Louis Forgione

# Principles of Neurological Surgery

Third Edition

**Richard G. Ellenbogen, MD, FACS**

Professor and Chairman  
Theodore S. Roberts Endowed Chair  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington  
USA

**Saleem I. Abdulrauf, MD, FAANS FACS**

Professor and Chairman  
Department of Neurological Surgery  
Saint Louis University School of Medicine  
Director, Saint Louis University Center  
for Cerebrovascular and Skull Base Surgery  
Neurosurgeon-in-Chief  
Saint Louis University Hospital  
St. Louis, Missouri  
USA

**Laligam N. Sekhar, MD, FACS**

Vice Chairman  
William Joseph Leedom and Bennett Bigelow Professor  
Director, Cerebrovascular Surgery and Skull Base Surgery  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington  
USA

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SAUNDERS



IN MEMORIAM

CHRISTOPHER C. GETCH, MD (1961-2012)

SETTI S. RENGACHARY, MD (1937-2008)

They floated through our lives for far too short a time. Professors Getch and Rengachary were renowned neurological surgeons, husbands, fathers, and mentors. These leaders taught using the tools of inspiration and patience. They operated with skill and compassion. And they brought happiness to all whose lives they touched. They remain heroes to their patients and role models to their students. They were forces of light and kindness in our field, and as our friends, made us better. We shall miss their intellect, humor, and gentle spirits. They shall forever remain as beacons of what the best of our field can bring to those we serve. We dedicate this edition to them.

*"Concern for man and his fate must always form the chief interest of all technical endeavors. Never forget this in the midst of your diagrams and equations."* Albert Einstein

To the loves of my life: Sandy, Rachel, Paul, and Zachary...thank you for my happiness  
and your great humor!

**Richard G. Ellenbogen, MD, FACS**

I dedicate this book to my patients for placing their deepest trust in us, as there is no higher trust than to  
place their lives in the hands of others. This trust represents our most seminal obligation.

I dedicate this book to my students, residents, and fellows, as there is no higher achievement than to see  
those whom we mentor go on to become compassionate and technically exceptional neurosurgeons.

**Saleem I. Abdulrauf, MD, FAANS, FACS**

I dedicate the book to my wife, Gordana, and my children, Raja, Daniela, and Krishna.

**Laligam N. Sekhar, MD, FACS**

# Contributors

**Saleem I. Abdulrauf, MD, FAANS, FACS**

Professor and Chairman  
Department of Neurological Surgery  
Saint Louis University School of Medicine  
Director, Saint Louis University Center for Cerebrovascular  
and Skull Base Surgery  
Neurosurgeon-in-Chief  
Saint Louis University Hospital  
St. Louis, Missouri, USA

**Francesco Acerbi, MD, PhD**

Department of Neurosurgery Fondazione IRCCS Istituto  
Neurologico Carlo Besta  
Milan, Italy

**Geoffrey Appelboom, MD**

Department of Neurological Surgery  
Columbia University College of Physicians and Surgeons  
New York, New York, USA

**Col. Rocco A. Armonda, MD**

Director, Cerebrovascular Surgery and Interventional  
Neuroradiology  
National Capital Neurosurgery Service  
Walter Reed Military Medical Center  
Director, Department of Neurosurgery  
Uniformed Services University of the Health Sciences  
Bethesda, Maryland, USA

**Danielle Balériaux, MD**

Emeritus Professor and Senior Consultant  
Department of Neuroradiology  
Erasme Hospital  
Université Libre de Bruxelles  
Brussels, Belgium

**Nicholas C. Bambakidis, MD**

Department of Neurological Surgery  
University Hospitals Case Medical Center  
Cleveland, Ohio, USA

**H. Hunt Batjer, MD**

Professor and Chair  
Northwestern University Feinberg School of Medicine  
Chairman  
Department of Neurological Surgery  
Northwestern Memorial Hospital  
Chicago, Illinois, USA

**Joel A. Bauman, MD**

Resident  
Department of Neurosurgery  
University of Pennsylvania  
Philadelphia, Pennsylvania, USA

**LCDR Randy S. Bell, MD**

Assistant Professor  
Uniformed Services University of Health Sciences  
Attending Neurosurgeon  
National Capital Neurosurgery Service  
Walter Reed National Military Medical Center  
Bethesda, Maryland, USA

**Shawn A. Belverud, DO, LCDR, MC, USN**

Staff Neurosurgeon  
Naval Medical Center San Diego  
San Diego, California, USA

**Bernard R. Bendok, MD, FACS**

Associate Professor of Neurosurgery  
Department of Neurosurgery  
Northwestern University Feinberg School of Medicine  
Northwestern Memorial Hospital  
Chicago, Illinois, USA

**Edward C. Benzel, MD**

Chairman  
Department of Neurosurgery  
Neurological Institute  
Cleveland Clinic  
Cleveland, Ohio, USA

**Mitchel S. Berger, MD**

Professor and Chairman  
Department of Neurological Surgery  
University of California, San Francisco  
San Francisco, California, USA

**Sandeep S. Bhangoo, MD, MS**

Chief Resident  
Department of Neurosurgery  
Henry Ford Hospital  
Detroit, Michigan, USA

**William Bingaman, MD**

Vice Chairman  
Neurological Institute  
Head  
Department of Epilepsy Surgery  
Cleveland Clinic  
Cleveland, Ohio, USA

**Peter Black, MD, PhD**

Professor of Neurosurgery  
Harvard Medical School  
Founding Chair  
Department of Neurosurgery  
Brigham and Women's Hospital  
Boston, Massachusetts, USA  
President of the World Federation of Neurosurgical Societies

**Benjamin Blondel, MD**

Spine Division  
Hospital for Joint Diseases  
New York University  
New York, New York, USA

**Giovanni Broggi, MD**

Professor of Neurosurgery  
Department of Neurosurgery  
Fondazione IRCCS Istituto Neurologico Carlo Besta  
Milan, Italy

**Morgan Broggi, MD**

Department of Neurosurgery  
Fondazione IRCCS Istituto Neurologico Carlo Besta  
Milan, Italy

**Jacques Brotchi, MD, PhD, FACS**

Emeritus Professor and Honorary Chairman  
Department of Neurosurgery  
Erasme Hospital  
Brussels, Belgium

**Samuel R. Browd, MD, PhD**

Assistant Professor of Neurological Surgery  
Associate Residency Director  
Department of Neurological Surgery  
University of Washington  
Attending Pediatric Neurosurgeon  
Director, Hydrocephalus Program  
Seattle Children's Hospital  
Seattle, Washington, USA

**Michaël Bruneau, MD, PhD**

Associate Professor  
Department of Neurosurgery  
Erasme Hospital  
Brussels, Belgium

**David W. Cadotte, MSc, MD**

Neurosurgical Resident  
Division of Neurosurgery  
University of Toronto  
Toronto, Ontario, Canada

**Paolo Cappabianca, MD**

Professor and Chairman of Neurosurgery  
Department of Neurological Sciences  
Division of Neurosurgery  
Università degli Studi de Napoli Federico II  
Naples, Italy

**Ricardo L. Carrau, MD, FACS**

Professor  
Department of Otolaryngology–Head and Neck Surgery  
Director of the Comprehensive Skull Base Surgery Program  
The Ohio State University Medical Center  
Columbus, Ohio, USA

**Luigi Maria Cavallo, MD, PhD**

Neurosurgery Instructor  
Department of Neurological Sciences  
Division of Neurosurgery  
Università degli Studi de Napoli Federico II  
Naples, Italy

**Juanita M. Celix, MD**

Resident  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Chris Cifarelli, MD, PhD**

Chief Resident  
Department of Neurological Surgery  
University of Virginia  
Charlottesville, Virginia, USA

**Lt. Michael Cirivello, MD**

Neurosurgery Resident  
National Capital Neurosurgery Consortium  
Walter Reed National Military Medical Center  
Bethesda, Maryland, USA

**Alan R. Cohen, MD, FACS, FAAP**

Reinberger Professor of Neurological Surgery  
Chief of Pediatric Neurosurgery  
Surgeon-in-Chief  
Rainbow Babies and Children's Hospital  
Case Western Reserve University School of Medicine  
The Neurological Institute  
University Hospitals Case Medical Center  
Cleveland, Ohio, USA

**E. Sander Connolly Jr., MD**

Bennett M. Stein Professor and Vice-Chair  
Department of Neurological Surgery  
Department of Neurological Intensive Care  
Columbia University College of Physicians and Surgeons  
New York, New York, USA

**Victor Correa-Correa, MD**

Research Fellow  
Harborview Medical Center  
National Institute of Neurology and Neurosurgery in Mexico  
Tlalpan, Mexico

**Aneela Darbar, MD**

Assistant Professor  
Department of Neurological Surgery  
Saint Louis University School of Medicine  
St. Louis, Missouri, USA

**Salvatore Di Maio, MDCM, FRCS(C)**

Fellow  
Department of Neurological Surgery  
University of Washington  
Harborview Medical Center  
Seattle, Washington, USA

**Christopher S. Eddleman, MD, PhD**

Department of Neurosurgical Surgery and Radiology  
UT Southwestern Medical Center  
Dallas, Texas, USA

**Richard G. Ellenbogen, MD, FACS**

Professor and Chairman  
Theodore S. Roberts Endowed Chair  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Jorge L. Eller, MD**

Assistant Professor  
Department of Neurological Surgery  
Saint Louis University School of Medicine  
St. Louis, Missouri, USA

**Felice Esposito, MD, PhD**

Neurosurgery Instructor  
Department of Neurological Sciences  
Division of Neurosurgery  
Università degli Studi de Napoli Federico II  
Naples, Italy

**Isabella Esposito, MD**

Neurosurgery Instructor  
Department of Neurological Sciences  
Division of Neurosurgery  
Università degli Studi de Napoli Federico II  
Naples, Italy

**Aria Fallah, MD**

Resident  
Division of Neurosurgery  
University of Toronto  
Toronto, Ontario, Canada

**Michael G. Fehlings, MD, PhD, FRCSC, FACS**

Professor and Krembil Chair in Neural Repair and Regeneration  
University of Toronto  
Toronto, Ontario, Canada

**Manuel Ferreira, Jr., MD, PhD**

Assistant Professor  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Aristotelis S. Filippidis, MD**

Division of Neurological Surgery  
Barrow Neurological Institute  
St. Joseph's Hospital and Medical Center  
Phoenix, Arizona, USA

**James R. Fink, MD**

Assistant Professor  
Department of Radiology  
University of Washington  
Seattle, Washington, USA

**Kathleen R. Tozer Fink, MD**

Assistant Professor  
Department of Radiology  
University of Washington  
Seattle, Washington, USA

**John C. Flickinger, MD, FACP**

Department of Radiation Oncology  
University of Pittsburgh Medical Center  
Pittsburgh, Pennsylvania, USA

**Rabindranath Garcia, MD**

Research Fellow  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Fred H. Geisler, MD, PhD**

Founder  
Illinois Neuro-Spine Center at Rush-Copley Medical Center  
Aurora, Illinois, USA

**Mikhail Gelfenbeyn, MD, PhD**

Assistant Professor  
Department of Neurological Surgery  
University of Washington  
Puget Sound Health Care System  
Veterans Administration Medical Center  
Seattle, Washington, USA

**Venelin M. Gerganov, MD**

Associate Neurosurgeon  
Department of Neurosurgery  
International Neuroscience Institute  
Hannover, Germany

**Christopher C. Getch, MD**

Professor  
Department of Neurological Surgery  
Northwestern University Feinberg School of Medicine  
Chicago, Illinois, USA

**George M. Ghobrial, MD**

Neurosurgery Resident  
Department of Neurological Surgery  
Thomas Jefferson University Hospital  
Philadelphia, Pennsylvania, USA

**Carlo Giussani, MD, PhD**

Division of Neurosurgery  
University of Milano-Bicocca  
Monza, Italy;  
Department of Neurological Surgery  
University of Washington School of Medicine  
Seattle, Washington, USA

**Atul Goel, MD**

Department of Neurosurgery  
K.E.M. Hospital  
Parel, Mumbai, India

**Ziya L. Gokaslan, MD, FACS**

Donlin M. Long Professor  
Professor of Neurosurgery, Oncology and Orthopaedic Surgery  
Vice-Chair  
Director of Neurosurgical Spine Program  
Department of Neurosurgery  
Johns Hopkins University School of Medicine  
Johns Hopkins Hospital  
Baltimore, Maryland, USA

**James Tait Goodrich, MD, PhD, DSci (Hon)**

Director, Division of Pediatric Neurosurgery  
Department of Neurosurgery  
Montefiore Medical Center  
Professor of Clinical Neurosurgery, Pediatrics, Plastic  
and Reconstructive Surgery  
Albert Einstein College of Medicine  
Bronx, New York, USA

**Gerald A. Grant, MD**

Associate Professor of Neurosurgery and Pediatrics  
Duke University  
Durham, North Carolina, USA

**Murat Gunel, MD**

Nixdoff-German Professor of Neurosurgery  
Chief, Yale Neurovascular Surgery Program  
Co-Director, Yale Program on Neurogenetics  
Yale University School of Medicine  
New Haven, Connecticut, USA

**Todd C. Hankinson, MD, MBA**

Assistant Professor of Neurosurgery  
Children's Hospital Colorado  
University of Colorado Denver  
Aurora, Colorado, USA

**James S. Harrop, MD**

Associate Professor of Neurologic and Orthopedic Surgery  
Jefferson Medical College  
Philadelphia, Pennsylvania, USA

**Alia Hdeib, MD**

Neurosurgery Resident  
Department of Neurological Surgery  
Neurological Institute  
University Hospitals Case Medical Center  
Cleveland, Ohio, USA

**Alan Hoffer, MD**

Director of Neurotrauma Program  
Assistant Professor  
Department of Neurological Surgery  
University Hospitals Case Medical Center  
Cleveland, Ohio, USA

**L. Nelson Hopkins, MD, FACS**

Professor and Chairman  
Departments of Neurosurgery and Radiology and  
Toshiba Stroke Research Center, School of Medicine and  
Biomedical Sciences  
University at Buffalo, State University of New York  
Department of Neurosurgery  
Millard Fillmore Gates Hospital  
Kaleida Health  
Buffalo, New York, USA

**Clifford M. Houseman, DO**

Resident  
Department of Neurological Surgery  
Cushing Neuroscience Institute  
Hofstra North Shore-LIJ School of Medicine  
Manhasset, New York, USA

**Gwyneth Hughes, MD**

Resident  
Neurological Surgery  
Cleveland Clinic Foundation  
Cleveland, Ohio, USA

**David F. Jimenez, MD, FACS**

Professor and Chairman  
Department of Neurosurgery  
University of Texas Health Sciences Center, San Antonio  
San Antonio, Texas, USA

**M. Yashar S. Kalani, MD, PhD**

Resident  
Division of Neurological Surgery  
Barrow Neurological Institute  
St. Joseph's Hospital and Medical Center  
Phoenix, Arizona, USA

**Amin B. Kassam, MD, FRCS(C)**

Professor and Chief of Neurosurgery  
University of Ottawa  
Ottawa, Ontario, Canada

**Robert F. Keating, MD**

Professor and Chief  
Division of Neurosurgery  
Children's National Medical Center  
George Washington University School of Medicine  
Washington, DC, USA

**Daniel Kelly, MD**

Director, Brain Tumor Center  
John Wayne Cancer Institute at Saint John's Health Center  
Santa Monica, California, USA

**Joanna Kemp, MD**

Department of Neurosurgery  
Saint Louis University School of Medicine  
St. Louis, Missouri, USA

**Melin Khandekar, MD, PhD**

Instructor  
Department of Radiation Oncology  
Harvard Medical School  
Assistant in Radiation Oncology  
Massachusetts General Hospital  
Boston, Massachusetts, USA

**Louis J. Kim, MD**

Assistant Professor  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Douglas Kondziolka, MD, MSc, FRCSC**

Peter J. Jannetta Professor of Neurological Surgery  
University of Pittsburgh  
Pittsburgh, Pennsylvania, USA

**Virginie Lafage, PhD**

Director, Spine Research  
Spine Division  
Hospital for Joint Diseases  
New York University  
New York, New York, USA

**Federico Landriel, MD**

Neurosurgery Chief Resident  
Fellow of the WFNS at Harvard University/  
Brigham and Women's Hospital  
Department of Neurological Surgery  
Hospital Italiano de Buenos Aires  
Buenos Aires, Argentina

**Geneviève Lapointe, MD, FRCSC**

Department of Neurological Surgery  
Saint Louis University School of Medicine  
St. Louis, Missouri, USA

**A. Noelle Larson, MD**

Assistant Professor  
Department of Orthopedic Surgery  
Mayo Clinic  
Rochester, Minnesota, USA

**Ilya Laufer, MD**

Assistant Attending  
Department of Neurosurgery  
Memorial Sloan-Kettering Cancer Center  
New York, New York, USA

**Jonathon J. Lebovitz, MD, MS**

Department of Neurological Surgery  
Saint Louis University School of Medicine  
St. Louis, Missouri, USA

**Florence Lefranc, MD, PhD**

Department of Neurosurgery  
Erasmus Hospital  
Université Libre de Bruxelles  
Brussels, Belgium

**Michael R. Levitt, MD**

Resident  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Elad I. Levy, MD, FACS, FAHA**

Professor  
Departments of Neurosurgery and Radiology and  
Toshiba Stroke Research Center  
School of Medicine and Biomedical Sciences,  
University at Buffalo, State University of New York  
Department of Neurosurgery  
Millard Fillmore Gates Circle Hospital  
Kaleida Health  
Buffalo, New York, USA

**James K.C. Liu, MD**

Resident  
Department of Neurological Surgery  
Neurological Institute  
Cleveland Clinic  
Cleveland, Ohio, USA

**Jay Loeffler, MD**

Chief  
Radiation Oncology  
Massachusetts General Hospital  
Boston, Massachusetts, USA

**John Loeser, MD**

Professor Emeritus  
Departments of Neurological Surgery and  
Anesthesiology and Pain Medicine  
University of Washington  
Seattle, Washington, USA

**Ramón López López, MD**

Research Fellow  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Timothy H. Lucas, II, MD, PhD**

Assistant Professor  
Department of Neurological Surgery  
University of Pennsylvania  
Philadelphia, Pennsylvania, USA

**L. Dade Lunsford, MD**

Lars Leksell Professor and Distinguished Professor  
Professor of Neurological Surgery and Radiology Oncology  
Director, Center for Image-Guided Neurosurgery  
Director, Residency Training Program  
University of Pittsburgh Medical Center  
Pittsburgh, Pennsylvania, USA

**Luke J. Macyszyn, MD**

Resident  
Department of Neurosurgery  
University of Pennsylvania  
Philadelphia, Pennsylvania, USA

**Marcella A. Madera, MD**

Neurosurgeon  
Austin Brain and Spine  
Seton Brain and Spine Institute  
Austin, Texas, USA

**Suresh N. Magge, MD**

Assistant Professor of Neurosurgery and Pediatrics  
George Washington University  
Division of Pediatric Neurosurgery  
Children's National Medical Center  
Washington, DC, USA

**Ghaus M. Malik, MD**

John R. Davis Chair in Neurosurgery  
Vice-Chairman  
Department of Neurosurgery  
Henry Ford Health System, Detroit  
Chief of Neurosurgery  
Henry Ford West Bloomfield Hospital  
Detroit, Michigan, USA

**Paul N. Manson, MD**

Professor of Surgery  
University of Maryland Shock Trauma Unit  
Professor of Surgery  
Johns Hopkins Hospital  
Baltimore, Maryland, USA

**Edward M. Marchan, MD**

Resident Physician  
Department of Neurosurgery  
Thomas Jefferson University  
Philadelphia, Pennsylvania, USA

**Carlo Marras, MD**

Center for Epilepsy Surgery and Neuro-Oncology  
Division of Neurosurgery  
Ospedale Pediatrico Bambino Gesù  
Roma, Italy

**Henry Marsh, CBE, MA, MD, FRCS**

Consultant Neurosurgeon  
Atkinson Morley's/St. George's Hospital  
London Professor  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Christian Matula, MD, PhD**

Professor of Neurosurgery  
Neurosurgical Department  
Medical University of Vienna  
Vienna, Austria

**Nancy McLaughlin, MD, PhD, FRCSC**

Neuroscience Institute and Brain Tumor Center  
John Wayne Cancer Institute at Saint John's Health Center  
Santa Monica, California, USA

**Giuseppe Messina, MD**

Department of Neurosurgery  
Fondazione IRCCS Istituto Neurologico Carlo Besta  
Milan, Italy

**Alessandra Mantovani, MD**

Research Fellow  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Ryan Morton, MD**

Resident  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Carrie R. Muh, MD, MS**

Assistant Professor of Neurosurgery and Pediatrics  
Division of Neurosurgery  
Duke University Medical Center  
Durham, North Carolina, USA

**Raj K. Narayan, MD**

Professor and Chairman  
Department of Neurosurgery  
Director  
Cushing Neuroscience Institute  
Hofstra North Shore-LIJ School of Medicine  
Manhasset, New York, USA

**Sabareesh K. Natarajan, MD, MS**

Clinical Assistant Instructor  
Department of Neurosurgery and  
Toshiba Stroke Research Center,  
School of Medicine and Biomedical Sciences  
University at Buffalo, State University of New York  
Department of Neurosurgery  
Millard Fillmore Gates Circle Hospital, Kaleida Health  
Buffalo, New York, USA

**Ajay Niranjana, MD, MBA**

Associate Professor of Neurological Surgery  
Director of Radiosurgery Research  
University of Pittsburgh Medical Center  
Pittsburgh, Pennsylvania, USA

**Jeffrey G. Ojemann, MD**

Professor  
 Department of Neurological Surgery  
 University of Washington  
 Richard G. Ellenbogen Chair in Pediatric Neurological  
 Surgery  
 Center for Integrative Brain Research, Seattle Children's  
 Research Institute  
 Chief  
 Division of Neurological Surgery  
 Seattle Children's Hospital  
 Seattle, Washington, USA

**Chima O. Oluigbo, MD, FRCSC**

Assistant Professor of Neurological Surgery  
 Department of Neurological Surgery  
 The Ohio State University Medical Center  
 Columbus, Ohio, USA

**Nelson M. Oyesiku, MD, PhD, FACS**

Al Lerner Chair and Vice-Chairman  
 Department of Neurosurgery  
 Professor of Neurosurgery and Medicine (Endocrinology)  
 Emory University School of Medicine  
 Director  
 Neurosurgery Residency Program  
 Editor-in-Chief, NEUROSURGERY  
 Atlanta, Georgia, USA

**Ali K. Ozturk, MD**

Resident Physician  
 Department of Neurosurgery  
 Yale University School of Medicine  
 New Haven, Connecticut, USA

**Sheri K. Palejwala, MD**

Department of Neurological Surgery  
 Saint Louis University School of Medicine  
 St. Louis, Missouri, USA

**Matthew Piazza**

Clinical Research Fellow  
 Department of Neurological Surgery  
 Columbia University College of Physicians and Surgeons  
 New York, New York, USA

**David W. Polly, Jr., MD**

Professor and Chief of Spine Surgery  
 Spine Division  
 University of Minnesota  
 Minneapolis, Minnesota, USA

**Daniel M. Prevedello, MD**

Assistant Professor  
 Department of Neurological Surgery  
 Director of Minimally Invasive Cranial Surgery Program  
 The Ohio State University Medical Center  
 Columbus, Ohio, USA

**Anja-Maria Radon**

Department of Neurological Surgery  
 Saint Louis University School of Medicine  
 St. Louis, Missouri, USA

**Govind Rajan, MBBS**

Associate Professor of Anesthesiology, Surgery, and Critical Care  
 Director of Clinical Anesthesiology and Operating Room Affairs  
 Director, Liver Transplant Anesthesia  
 Saint Louis University School of Medicine  
 St. Louis, Missouri, USA

**Ali R. Rezai, MD**

Julius F. Stone Chair  
 Professor of Neurosurgery  
 Director  
 Ohio State University Center for Neuromodulation  
 Vice Chair, Clinical Research  
 Department of Neurological Surgery  
 The Ohio State University Medical Center  
 Columbus, Ohio, USA

**Eduardo Rodriguez, MD, DDS**

Chief of Plastic Surgery  
 Associate Professor  
 University of Maryland Shock Trauma Unit  
 Associate Professor  
 Johns Hopkins Hospital  
 Baltimore, Maryland, USA

**James T. Rutka, MD, PhD, FRCSC**

Professor and Chair  
 Department of Surgery  
 University of Toronto  
 Toronto, Ontario, Canada

**Madjid Samii, MD, PhD**

President of the International Neuroscience Institute  
 Hannover, Germany  
 President of the China International Neuroscience Institute  
 at the Capital University of Medical Sciences  
 Beijing, China

**Mical Samuelson, MD**

Neurosurgery Resident  
 Department of Neurosurgery  
 University of Texas Health Science Center, San Antonio  
 San Antonio, Texas, USA

**Nader Sanai, MD**

Director  
 Division of Neurosurgical Oncology  
 Director, Barrow Brain Tumor Research Center  
 Barrow Neurological Institute  
 Phoenix, Arizona, USA

**Deanna Sasaki-Adams, MD**

Assistant Professor  
 Department of Neurological Surgery  
 Saint Louis University School of Medicine  
 St. Louis, Missouri, USA

**Jennifer Gentry Savage, MD**

Neurosurgery Chief Resident  
Department of Neurosurgery  
University of Texas Health Science Center, San Antonio  
San Antonio, Texas, USA

**David Schlesinger, PhD**

Assistant Professor of Radiation Oncology and Neurological  
Surgery  
University of Virginia  
Charlottesville, Virginia, USA

**Frank Schwab, MD**

Clinical Professor  
Chief of the Spinal Deformity Service  
Spine Division  
Hospital for Joint Diseases  
New York University  
New York, New York, USA

**Daniel Sciubba, MD**

Assistant Professor  
Department of Neurosurgery  
Johns Hopkins Hospital  
Baltimore, Maryland, USA

**R. Michael Scott, MD**

Professor of Surgery  
Department of Surgery (Neurosurgery)  
Harvard Medical School  
Neurosurgeon-in-Chief  
Children's Hospital Boston  
Boston, Massachusetts, USA

**Laligam N. Sekhar, MD, FACS**

Vice Chairman  
William Joseph Leedom and Bennett Bigelow Professor  
Director, Cerebrovascular Surgery and Skull Base Surgery  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Warren Selman, MD**

The Harvey Huntington Brown, Jr., Professor and Chair  
Department of Neurological Surgery  
Case Western Reserve University  
Director  
The Neurological Institute  
University Hospitals  
Cleveland, Ohio, USA

**Mitchel Seruya, MD**

Resident  
Plastic Surgery  
Georgetown University Hospital  
Washington, DC, USA

**Spyros Sgouros, MD, FRCS(SN)**

Assistant Professor of Neurosurgery  
University of Athens  
Director  
Department of Pediatric Neurosurgery  
"Mitera" Childrens Hospital  
Athens, Greece

**Jason P. Sheehan, MD, PhD**

Alumni Professor of Neurological Surgery and Radiation  
Oncology  
Director of Lars Leksell Gamma Knife Center  
Vice Chair of Academic Affairs  
University of Virginia  
Charlottesville, Virginia, USA

**Helen Shih, MD, MS, MPH**

Assistant Professor of Radiation Oncology  
Harvard Medical School  
Chief, Central Nervous System and Eye Services  
Department of Radiation Oncology  
Massachusetts General Hospital  
Boston, Massachusetts, USA

**Adnan H. Siddiqui, MD, PhD**

Associate Professor  
Departments of Neurosurgery and Radiology and  
Toshiba Stroke Research Center,  
School of Medicine and Biomedical Sciences  
University at Buffalo, State University of New York  
Department of Neurosurgery  
Millard Fillmore Gates Circle Hospital, Kaleida Health  
Buffalo, New York, USA

**Daniel L. Silbergeld, MD, FACS**

Arthur A. Ward, Jr., Professor  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Justin Singer, MD**

Resident  
Department of Neurological Surgery  
University Hospitals Case Medical Center  
Cleveland, Ohio, USA

**Edward R. Smith, MD**

Director, Pediatric Cerebrovascular Surgery  
Department of Neurosurgery  
Children's Hospital Boston  
Associate Professor of Surgery  
Harvard Medical School  
Boston, Massachusetts, USA

**Vita Stagno, MD**

Resident  
Department of Neurological Sciences  
Division of Neurosurgery  
Università degli Studi de Napoli Federico II  
Naples, Italy

**Juraj Šteňo, Prof, MD, PhD**

Professor  
Head of the Department of Neurosurgery  
Comenius University Medical Faculty  
Bratislava, Slovakia

**Leslie N. Sutton, MD**

Professor  
University of Pennsylvania School of Medicine  
Chief Neurosurgery  
Children's Hospital of Philadelphia  
Philadelphia, Pennsylvania, USA

**Justin M. Sweeney, MD**

Department of Neurological Surgery  
Saint Louis University School of Medicine  
St. Louis, Missouri, USA

**Alexander S. Taghva, MD**

Department of Neurological Surgery  
University of Southern California, Keck School of Medicine  
Los Angeles, California, USA

**Farzana Tariq, MD**

Senior Fellow  
Department of Neurological Surgery  
University of Washington  
Seattle, Washington, USA

**Charles Teo, MD**

Associate Professor and Chairman  
Prince of Wales Private Hospital  
University of New South Wales  
Director  
Centre for Minimally Invasive Neurosurgery  
Sydney, Australia

**Nicholas Theodore, MD, FACS**

Professor  
Chief, Spine Section  
Division of Neurological Surgery  
Director, Neurotrauma Program  
Barrow Neurological Institute  
St. Joseph's Hospital and Medical Center  
Phoenix, Arizona, USA

**R. Shane Tubbs, MS, PA-C, PhD**

Anatomist/Research  
Children's Hospital  
Birmingham, Alabama, USA

**Aimee Two, MD**

Resident Physician  
Department of Neurological Surgery  
University of Southern California, Keck School of Medicine  
Los Angeles, California, USA

**Scott D. Wait, MD**

Pediatric Neurosurgery Fellow  
LeBonheur Children's Hospital/St. Jude's Children's Research  
Hospital  
Memphis, Tennessee, USA

**Grace Elisabeth Walter**

Central Michigan University  
Mount Pleasant, Michigan, USA

**Adrienne Weeks, PhD**

Department of Neurosurgery  
University of Toronto  
Toronto, Ontario, Canada

**John C. Wellons, III, MD**

Professor of Surgery and Pediatrics  
Section of Pediatric Neurosurgery  
University of Alabama–Birmingham  
Children's Hospital of Alabama  
Birmingham, Alabama, USA

**Lynda J-S Yang, MD, PhD**

Associate Professor  
Department of Neurosurgery  
University of Michigan Health System  
Ann Arbor, Michigan, USA

**Chun Po Yen, MD**

Clinical Instructor  
Department of Neurological Surgery  
University of Virginia  
Charlottesville, Virginia, USA

# Preface

*Concern for man and his fate must always form the chief interest of all technical endeavors...Never forget this in the midst of your diagrams and equations.*

Albert Einstein

*Principles of Neurological Surgery* is in its third edition because of the popular demand of our students. As I walk through the hospital and operating room, I am thrilled to see the previous editions being read by medical students, house officers, nurses, and practicing neurosurgeons. It is for these treasured students, young and old, novice and experienced, that this book is intended. It is to be used to guide both those learning and those teaching. We are indebted to our students for inspiring us to perform at our best every day, for in the operating room our best is required by our patients all the time. At the end of the day, we hope this edition contributes to the modest goal of shaping more effective clinicians, ultimately for the benefit of our patients.

The world of medical education has evolved rapidly, and our students do not necessarily learn in the same manner we once learned. We have listened carefully to their constructive comments and re-created a book that addresses their individual approach to learning basic neurological surgery principles. Scientific information is growing at an exponential rate. Thus, mastering the wide spectrum of neurological surgery is arguably even more challenging for the current generation of students than it was for our generation. A host of excellent encyclopedic neurological surgery reference texts currently are available. Our work is intended to be comprehensive without being encyclopedic. We hope it could be the sort of tool that students can use every day of their training and then carry into practice. We realize that the internet and searchable peer-reviewed literature have often supplanted multivolume collections. So we took a different approach with this text. It is our goal to make the complex and broad spectrum of neurological surgery more comprehensible by reviewing the surgical principles in a concisely written, template-oriented,

and visually attractive format. The text is purposely designed to fit in a single volume so that the information is digestible and can be successfully reinforced with subsequent review. The chapter topics represent both basic core areas and novel subject matter in our rapidly evolving field. The authors have added CLINICAL PEARLS to their chapters that sum up the critical bullet points of the chapters. The chapters are further supplemented with five SELECTED KEY REFERENCES from the bibliography, which the authors believe are worthy of in-depth investigation. Furthermore, we have listened to our students' desire for visual reinforcement and simulation to master psychomotor skills in the operating room. For that reason, we have added video clips for key operations in this textbook. They can be downloaded from the Elsevier website and reviewed at any time from any location by those who desire to augment their understanding of the material.

In the third edition, I was fortunate to be joined by two exceptional neurological surgery talents: Professors Sekhar and Abdulrauf. These two professors possess a keen eye for the critical elements of our field. They are internationally recognized as master educators, as well as technical virtuosos. Of course, the success of this book truly rests upon a team of world class contributing scholars, known for their specific expertise. Therefore the third edition enlisted new contributions from these internationally renowned neurosurgeons. The text by these authors was then combined with the work of highly skilled artists employing cutting-edge art technology. The entire project was then overseen by a patient and experienced Elsevier editing team.

I am deeply grateful to the authors, artists, and editors for the precious time and hard work invested in this third edition. They created a book with extraordinary visual appeal, containing accurate, evidence-based explanations, beautiful color illustrations, simple tables, illustrative photographs, and video highlights. It is our hope that this approach will be substantive, long lived, and enjoyable for our readers and beneficial to our patients.

Richard G. Ellenbogen

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*R. Shane Tubbs, Todd C. Hankinson, John C. Wellons, III*

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