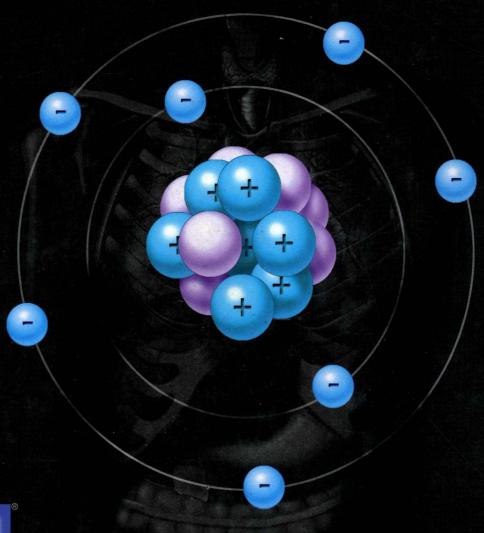
# Diagnostic Imaging

# Nuclear Medicine

SECOND EDITION

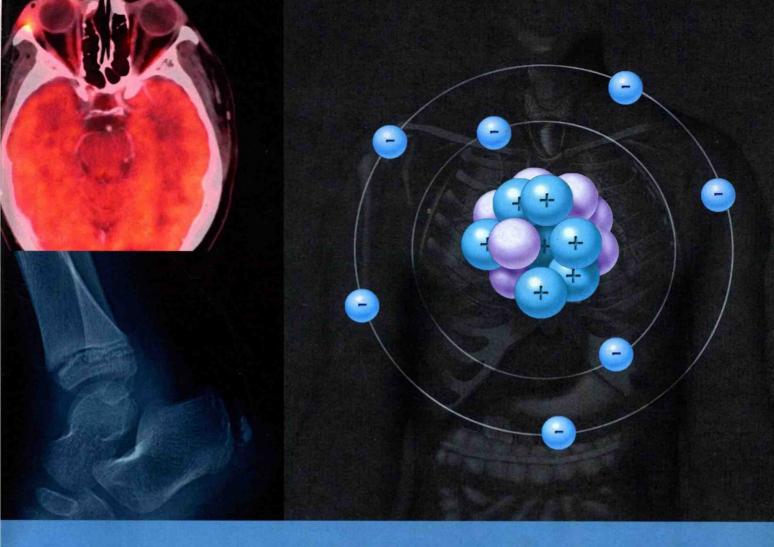




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DIAGNOSTIC IMAGING: NUCLEAR MEDICINE, SECOND EDITION

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# Dedications

This book is dedicated to my family. To Diane and Ted Bennett, who love me the most. To Betsy, Sidney, and Lee Andrew Clark, the loves of my life. To my extended family of friends, Dr. Kathryn Morton, Cecilia Vargas Ortega. Nothing matters without all of you.

Thank you to everyone who works with Amirsys: Your professionalism, leadership, and vision created the Diagnostic Imaging series, of which we are all proud to be a part. Arthur Gelsinger and Dr. Umesh Oza: You made this endeavor fun. Double thanks.

PB

While we have laboriously poured heart, soul, and spirit into this textbook to impart the leading edge of nuclear medical knowledge to the next generation, there has been an equally and painstaking devotion paid to us by loved ones and mentors that have dedicated time, wisdom, guidance, and advice that cannot, and should not, go unrecognized. To my beautiful wife, Komel, thank you for your strength, guidance, and unwavering resolve. To my children, Quaid and Willa, you are my driving force. I want for you what you have given me — courage to strive for better, enjoy life to the absolute fullest, and run with wild abandon. To my loving parents, Dhruv and Surekha, thank you for your lifelong sacrifice, instilling discipline and confidence and single-minded focus raising three successful children. To Rishi and Veena, thank you for your unconditional love and steadfast support. A project of this magnitude reflects the hard efforts of many underrecognized people. I extend my deepest gratitude to all of you — thank you!



# Contributing Authors



# Angela P. Bruner, PhD, DABR

Director, Radiation Safety Officer, Medical Physicist Radiation Safety & Medical Physics Baylor Scott & White Health - North Texas Dallas, Texas

# Hollins Clark, MD

Associate Professor Department of Radiology Wake Forest School of Medicine Winston-Salem, North Carolina

# Pushpender Gupta, MBBS

Assistant Professor Department of Radiology Wake Forest School of Medicine Winston-Salem, North Carolina

# John M. Holbert, MD, FACR

Professor of Diagnostic Radiology Department of Radiology Wake Forest School of Medicine Winston-Salem, North Carolina

# Brian Kouri, MD

Associate Professor Department of Radiology Wake Forest School of Medicine Winston-Salem, North Carolina

# Shane C. Masters, MD, PhD

Assistant Professor Department of Radiology Wake Forest School of Medicine Winston-Salem, North Carolina

# Anita Thomas, MD

Associate Professor Department of Radiology Wake Forest School of Medicine Winston-Salem, North Carolina

# Christopher T. Whitlow, MD, PhD, MHA

Section Head, Neuroradiology Associate Professor Department of Radiology Wake Forest School of Medicine Winston-Salem, North Carolina

# Matthew Bennett, MD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Todd Michael Danziger, MD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# James Patrick Davidson, MD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Trevor Downing, MD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Christopher R. McAdams, MD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Amie M. McPherson, MD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Virginia Barnes Planz, MD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina



# Colin Segovis, MD, PhD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Valerie E. Stine, MD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Pavani Thotakura, MD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Paula Vergara-Wentland, MD

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Bimal Vyas, MD, MS

Department of Radiology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Amanda Jo Lott Marcellino, MD

Department of Otolaryngology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Ashley C. Mays, MD

Department of Otolaryngology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# T. Alex McKnight, MD

Department of Otolaryngology Wake Forest Baptist Medical Center Winston-Salem, North Carolina

# Kelli Y. Ha, MD

Department of Radiology, Breast Imaging Baylor University Medical Center Dallas, Texas

# Tejaswini Vasamsetty, MD

Research Assistant
Department of Radiology
Wake Forest School of Medicine
Winston-Salem, North Carolina

# John Bailey, MD

Wake Forest School of Medicine Winston-Salem, North Carolina

# Aidan Burke, MD

Wake Forest School of Medicine Winston-Salem, North Carolina

# Daniel G. Hampton, MD

Wake Forest School of Medicine Winston-Salem, North Carolina

# Katarina Kesty, MD, MBA

Wake Forest School of Medicine Winston-Salem, North Carolina

# Zachary Allen Lindsey, MD

Wake Forest School of Medicine Winston-Salem, North Carolina

# Charlotte Myers, MD

Wake Forest School of Medicine Winston-Salem, North Carolina

# Bryan J. Neth, BS

Wake Forest School of Medicine Winston-Salem, North Carolina

# Brad Perry, MD

Wake Forest School of Medicine Winston-Salem, North Carolina

# G. Lance White, MD

Wake Forest School of Medicine Winston-Salem, North Carolina

# Preface





Since the publication of the first edition of Diagnostic Imaging: Nuclear Medicine, the world of nuclear medicine and molecular imaging has continued to rapidly evolve. PET/CT remains the most substantial advancement in the field in recent times, with PET/CT volumes continuing to climb. New PET/CT radiopharmaceuticals and time-of-flight technology have both become more mainstream. Astounding leaps have occurred in equipment such as with the incredible integrated PET/MR systems. Awareness of radiation dose to the patient has moved to the forefront of consciousness, and advances in software and detector equipment have helped dramatically lower radiation exposure. At the same time, many new therapies, radiotracers, and techniques push the boundaries of what is possible, showing the enduring importance of nuclear medicine in patient care.

The second edition reflects the changes seen in practice. Careful attention has been paid to the recent revisions in radioiodine therapy guidelines for cancer and hyperthyroidism. New chapters have been added, which cover the use of Ra-223 for the treatment of painful prostate cancer bone metastases and the use of I-123 ioflupane (DaTscan) for the diagnosis of parkinsonian syndromes. F-18 NaF PET/CT assessment for the bones is now thoroughly covered, including its indication for nonaccidental trauma in children. In addition, many of the popular quick reference tables have been added. These include easy-touse tables in the completely updated pulmonary embolism chapter and differential diagnosis tables such as in the musculoskeletal chapters.



In order to make this text a more complete reference and study tool, new chapters have been dedicated to nuclear medicine physics and Nuclear Regulatory Commission (NRC) guidelines. In fact, all study guide topics listed for the American Board of Radiology board exam are fully covered. A radiopharmaceutical table now provides a critical overview, covering key parameters of the important agents currently in use. While these items are especially valuable for the physician preparing to undergo recertification or certification, they are also useful for the practitioner in the field.

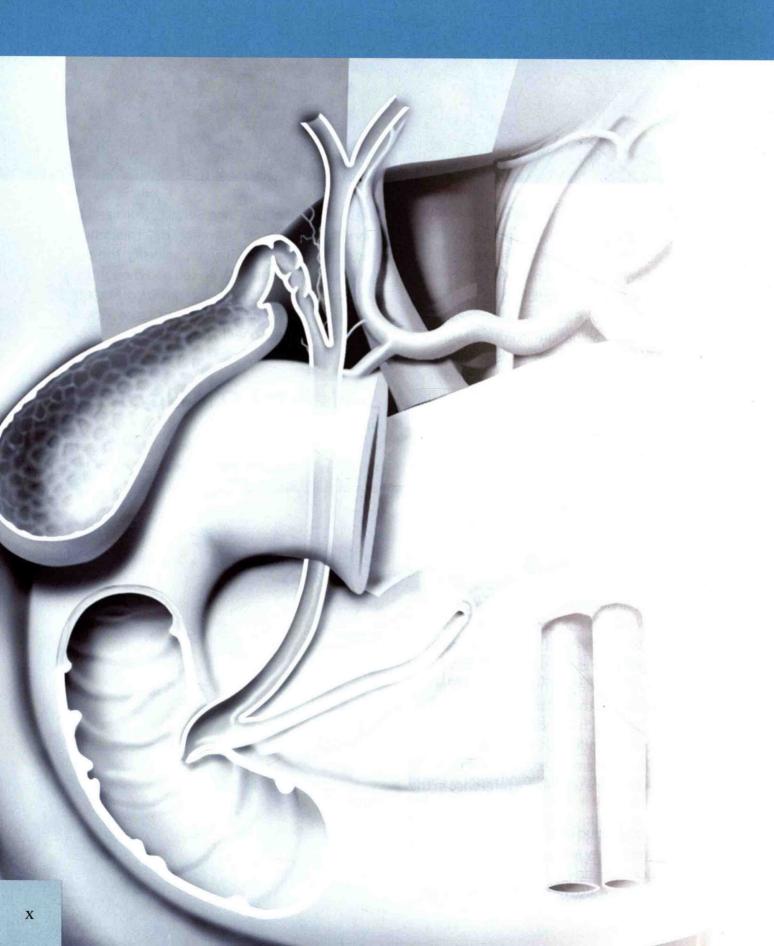
Certainly, this edition continues to build on the successful philosophy of its predecessor. The topic-based format allows the reader to rapidly approach cases from the most practical standpoint. Incredible images illustrate the spectrum of disease, highlight potential pitfalls in the differential diagnosis, and outline critical anatomy. Each section contains multiple new images, maintaining the high standards expected from the *Diagnositc Imaging* series. Bulleted text describes all the details needed, from the level of the novice to that of the expert, but keeps the focus of each section sharp. Expanded sections have been added to better cover image interpretation and exam protocol advice, making this edition even more useful as a reference in the clinic.

We are especially proud of the team assembled to compile this text. They are a group of dedicated nuclear medicine physicians and nuclear radiologists who are also gifted teachers. Under the leadership of Dr. Paige Bennett (formerly Clark) of Wake Forest University Health Sciences and Dr. Umesh Oza of Baylor University, the text continues to be carefully edited and thoughtfully developed. In short, *Diagnostic Imaging: Nuclear Medicine, Second Edition*, continues to be a must-have for any practioner in the field.

# Janis Petrik O'Malley, MD

Professor of Radiology

Director, Division of Molecular Imaging and Therapeutics University of Alabama at Birmingham School of Medicine Birmingham, Alabama



# Acknowledgements

# **Text Editors**

Nina I. Bennett, BA
Sarah J. Connor, BA
Tricia L. Cannon, BA
Terry W. Ferrell, MS
Lisa A. Gervais, BS
Karen E. Concannon, MA, PhD

# **Image Editors**

Jeffrey J. Marmorstone, BS Lisa A. M. Steadman, BS

# **Medical Editors**

Philippe A. Tirman, MD Whitney J. Morgan, MD

# Illustrations

Richard Coombs, MS Lane R. Bennion, MS Laura C. Sesto, MA

# Art Direction and Design

Tom M. Olson, BA Laura C. Sesto, MA

# Lead Editor

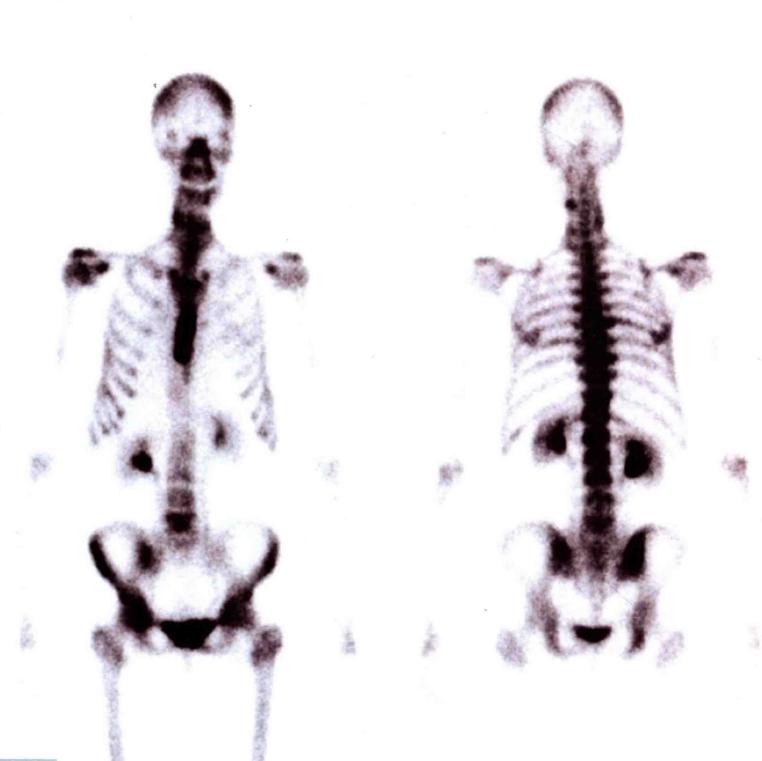
Arthur G. Gelsinger, MA

# **Production Coordinators**

Angela M. G. Terry, BA Rebecca L. Hutchinson, BA







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