BOOK REVIEWS

All interested medical physicists are encouraged to have their names added to a list of available reviewers. Please rank your interest among radiation therapy, x-ray, imaging, nuclear medicine imaging, ultrasound imaging, MR imaging, radiation injury, radiation protection, and others. Make your interest known to Dimitris Mihailidis, Ph.D., Books Review Editor (dimitris@charlestonradiation.com). Include your name and e-mail address in the body of the response.

Molecular Imaging of Small Animals. Instrumentation and Applications. Editor: H. Zaidi. Springer-Verlag, Heidelberg, NY, 2014. 760 pp. Price: $239.00. ISBN: 978-1-4939-0893-6 (hardcover).

Description

This book provides a comprehensive account of the state-of-the-art technologies used for small animal multimodality imaging. It includes dual modalities, such as PET/CT, SPECT/CT, PET/MR, and SPECT/PET. Although the book describes a number of small animal imaging applications in oncology, neurology, cardiology, and inflammation, its primary focus is on the various instrumentations used in detection and image formation. The text is fairly technical and hence relevant to experienced scientists in the field, as well as science, engineering, and medical students.

Purpose

Molecular imaging is a multidisciplinary field, combining the disciplines of physics, chemistry, biology, engineering, mathematics, and medicine. Over the last two decades, it has shown an unprecedented "step change," capitalizing on advancements made in molecular biology, genomics, proteomics, and nanotechnology. These have been underpinned by new developments in instrumentation, image processing, and chemistry. These advancements have made tremendous strides in preclinical research and clinical diagnostics. More recently, these advancements have positioned molecular imaging at the forefront of precision and personalized medicine. The pressing need to study health and disease within the intact live subject can only be provided by molecular imaging. This book aims to provide the foundation of small animal molecular imaging. In this regard, it successfully fulfills its objectives by covering, in reasonable detail, the instrumentation for various imaging modalities. The book also contains a complementary chapter on radiotracer development for PET and SPECT to illustrate the concept of targeted molecular imaging. It provides a good account of various medical applications of small animal imaging, including imaging in drug development and genomics.

Audience

Although not stated by the editor, the book is intended for molecular imaging scientists. It may also be useful for medical physicists, chemists, biomedical engineers, and classroom lectures in molecular imaging. Graduate students in medical physics, biomedical engineering, radiochemistry, and other related disciplines will find the detail in most chapters very insightful. Additionally, this book is ideal for core facilities and libraries where investigators use molecular imaging in their research.

Content/Features

The book discusses the topic of small animal molecular imaging with emphasis on the various instrumentations employed in multimodality molecular imaging. It even highlights some biomedical applications of the various imaging technologies currently being used. The book is a fantastic reference for SPECT, PET, CT, and MR imaging instrumentation, which is particularly well covered. It includes the latest advances in "hybrid" instrumentation, such as PET/MR and SPECT/MR. In this regard, the text is well illustrated with diagrams, images, and artistic presentations. The chapters on instrumentation are well detailed and go into depth about specific aspects of detector design, and performance parameters in sensitivity, resolution, and dynamic range. The application chapters are reasonably comprehensive and touch upon the main biomedical applications of small animal molecular imaging.

Assessment/Comparison

Since molecular imaging is a multidisciplinary field, this book will have a broad appeal to the biomedical research community. It will also appeal to diverse imaging scientists because it covers the technologies of various modalities: PET, SPECT, CT, MR, and optical imaging. How is it able to do this? It deals with the instrumentation technology of each modality as well as within the context of dual modality imaging. In a few chapters, the book also illustrates how the technologies are applied in a number of biomedical research subjects. Because the book focuses on small animal molecular imaging, it provides a unique reference resource for the increasingly emerging field of multimodality molecular imaging. It complements other books on medical imaging (e.g., Webb's Physics of Medical Imaging, edited by M. A. Flower, CRC Press, and PET: Molecular Imaging and Its Biological Applications, edited by M. E. Phelps, Springer) and provides a "niche" focus on small animal applications. Various readers will appreciate this book at different levels. Imaging scientists, students in imaging physics, biomedical engineering, and radiochemistry can make use of many chapters having a fundamental description of some of the different aspects and methods of molecular imaging.

Reviewed by Jamal Zweit, Ph.D., D.Sc. and Sundaresan Gobalakrishnan, Ph.D.

Jamal Zweit is a professor of Radiology and affiliate Professor of Radiation Oncology, Pathology, Biochemistry and Molecular Biology and Chemistry at

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Virginia Commonwealth University (VCU). He is also the Director of the Center for Molecular Imaging at VCU, School of Medicine. His research interests include the development of molecular imaging paradigms to study in vivo biology and the working of therapy. His research also includes the merging of molecular imaging and nanotechnology for targeted multimodality imaging and therapy.

Sundaresan Gobalakrishnan is an Assistant Professor of Radiology and heads the multimodality molecular imaging laboratory at the Center for Molecular Imaging, Virginia Commonwealth University in Richmond, VA, USA. He is well experienced in establishing preclinical multimodality molecular imaging laboratories in academia and pharmaceutical industry.

Cardiac imaging is challenging in small animals due to their rapid heart rate (âˆ¼600 bpm for mice). Like respiratory gating (see Lung Imaging), cardiac gating can be used to minimize artifacts due to cardiac motion in the resulting CT images. Cardiac gating can be performed either prospectively (Badea et al., 2005, 2008a, 2011b; Ford et al., 2005; Guo et al., 2011) or retrospectively (Bartling et al., 2007; Song et al., 2007; Badea et al., 2008a, 2011c; Ashton et al., 2014a).Â Such imaging is possible with low molecular weight contrast agents by using continuous administration or repeated injections (Sawall et al., 2012), but the vast majority of studies have made use of blood pool contrast agents, which make cardiac-gated CT protocols practical. In vivo small-animal imaging is playing a pivotal role in the scientific research paradigm enabling to understand human molecular biology and pathophysiology using, for instance, genetically engineered mice with spontaneous diseases that closely mimic human diseases. ...more. Get A Copy. Amazon. Online Stores â–¾. Audible Barnes & Noble Walmart eBooks Apple Books Google Play Abebooks Book Depository Alibris Indigo Better World Books IndieBound. Libraries. Paperback, 760 pages. Crump Institute for Molecular Imaging, Department of Molecular and Medical Pharmacology, UCLA School of Medicine, Box 951770 UCLA, Los Angeles, CA 90095-1770, USA. Biological discovery has moved at an accelerated pace in recent years, with a considerable focus on the transition from in vitro to in vivo models. As a result, there has been a significant increase in the need to adapt clinical imaging methods, as well as for novel imaging technologies for biological research.Â This paper presents the challenges facing PET technology as applied to small animal imaging, provides a historical overview of the development of small animal PET systems, and discusses the current state of the art in small animal PET technology. Download full-text PDF. Source.