In Vivo Optical Imaging Of Brain Function Second Edition Frontiers In Neuroscience | 6654187987462f574bdd154a5818c16f

In Vivo Optical Imaging of Brain Function

Electrocardiographic Imaging

Establishing “in Vivo” Optical Imaging Technologies Based Upon BLI (bioluminescence imaging) of B16F10 Melanoma. In Vivo Optical Imaging of Cell Death Using Fluorescent Synthetic Coordination Complexes

Handbook of In Vivo Chemistry in Mice

Modern Techniques in Neuroscience

Research challenges and emerging techniques are associated with the new field of optogenetics. In Vivo Optical Imaging of Brain Function allows for the investigation of firing patterns of distinct neuronal populations and to investigate neurovascular structure and cerebral hemodynamics. High-resolution imaging in microscopy and in Ophthalmology.

In Vivo Optical Imaging of Brain Function, Second Edition

Molecular Imaging Optical Imaging Techniques in Cell Biology

Optical Imaging of Cancer

Biology and Fluorescence for in Vivo Imaging in Living Tissue: Imaging technology allows for the investigation of tissue optical clearing as an instrument for improving the diagnostic (including pathological tissues) and blood for optical imaging diagnosis and therapy. This book provides a comprehensive account of the latest research and possibilities of utilizing optical clearing as an instrument for improving the diagnostic application.

The present book gives an exceptional overview of molecular imaging. Practical approach represents the red thread through the whole book, covering at the same time detailed background information that goes very deep into molecular as well as cellular level. Ideas how molecular imaging will develop in the near future present a special delicacy. This should be of special interest to the readers who are members of leading research groups from all over the world. Cutting-edge in vivo imaging technologies and diagnostic techniques In Vivo Clinical Imaging and Diagnosis features tissues into optical clearing agents (OCAs) that reduces the scattering of tissue and makes tissue more transparent and this method has been successfully used ever since. This book is a self-contained introduction to tissue optical imaging and lends context to the following sections, which examine applications in single neurons, networks, large neuronal populations and the heart. Topics discussed include population membrane potential signals in development of the vertebrate nervous system, use of membrane potential imaging from dendrites and axons, and depth-resolved optical imaging of cardiac activation and repolarization. The final section discusses the potential and limitations for new developments in the field, including new technology such as non-linear optics, advanced microscope designs and genetically encoded voltage sensors. Membrane Potential Imaging in the Nervous System and Heart is ideal for neurologists, electro physiologists, cardiologists and those who are interested in the applications and the future of membrane potential imaging. Biomedical photonics is currently one of the fastest growing fields, connecting research in physics, optics, and electrical engineering coupled with medical and biological applications. It allows for the structural and functional analysis of tissues and cells with resolution and contrast unattainable by any other methods. However, the many different photonics technologies available in the field of optical imaging have the potential to resolve structures further to the sub-cellular level as well as translate them for in vivo studies. The tissue optical clearing method uses immersion of tissues into optical clearing agents (OCAs) that reduces the scattering of tissue and makes tissue more transparent and this method has been successfully used ever since. This book is a self-contained introduction to tissue optical clearing, including the basic principles and in vitro biological applications, from in vitro to in vivo tissue optical clearing methods, and combination of tissue optical clearing and various optical imaging for diagnosis. The chapters cover a wide range of issues related to the field of tissue optical clearing: mechanisms of tissue optical clearing in vitro and in vivo; traditional and innovative optical clearing agents; recent achievements in optical clearing of different tissues (including pathological tissues) and blood for optical imaging diagnosis and therapy. This book provides a comprehensive account of the latest research and possibilities of utilising optical clearing as an instrument for improving the diagnostic function.
effectiveness of modern optical diagnostic methods. The book is addressed to biophysicist researchers, graduate students and postdocs of biomedical specialties, as well as biomedical engineers and physicians interested in the development and application of optical methods in medicine. Key features: The first collective reference to collate all known knowledge on this topicEdited by experts in the field with chapter contributions from subject area specialistsBrings together the two main approaches in immersion optical clearing in a single book--Provides a comprehensive coverage of in vivo chemical reactions within live animals. This handbook summarizes the interdisciplinary expertise of both chemists and biologists performing in vivo chemical reactions within live animals. By comparing and contrasting currently available chemical and biological techniques, it serves not just as a collection of the pioneering work done in animal-based studies, but also as a technical guide to help readers decide which tools are suitable and best for their experimental needs. The Handbook of In Vivo Chemistry in Mice: From Lab to Living System introduces readers to general information about live animal experiments and detection methods commonly used for these animal models. It focuses on chemistry-based techniques to develop selective in vivo targeting methodologies, as well as strategies for in vivo chemistry and drug release. Topics include: currently available mouse models; biocompatible fluorophores; radionuclides for radiotherapy; living PET imaging; bioluminescence imaging; magnetic resonance imaging (MRI); ultrasound imaging; hybrid imaging; biocompatible chemical reactions; ligand-directed nucleophilic substitution chemistry; biorthogonal prodrug release strategies; and various selective targeting strategies for live animals. -Completely covers current hybrid techniques of in vivo chemistry performed in live animals -Describes general information about commonly used live animal experiments and detection methods -Focuses on chemistry-based techniques to develop selective in vivo targeting methodologies, as well as strategies for in vivo chemistry and drug release -Places emphasis on material properties required for the development of appropriate compounds to be used for imaging and therapeutic purposes in preclinical applications Handbook of In Vivo Chemistry in Mice: From Lab to Living System will be of great interest to pharmaceutical chemists, life scientists, and organic chemists. It will also appeal to those working in the pharmaceutical and biotechnology industries. Imaging from Cells to Animals In Vivo offers an overview of optical imaging techniques developed over the past two decades to investigate biological processes in live cells and tissues. It comprehensively covers the main imaging approaches used as well as the application of those techniques to biological investigations in preclinical models. Among the areas covered are cell metabolism, receptor-ligand interactions, membrane trafficking, cell signaling, cell migration, cell adhesion, cytoskeleton and other processes using various molecular optical imaging techniques in live organisms, such as mice and zebrafish. Features Brings together biology and advanced optical imaging techniques to provide an overview of progress and modern methods from microscopy to whole body imaging. Fills the need for a broadly based book to use as a textbook and to ask new questions in the context of a living system. Includes basic chapters on key methods and instrumentation, from fluorescence microscopy and imaging to endoscopy, optical coherence tomography and super-resolution imaging. Discusses approaches at different length scales and biomedical applications to the study of single cell, whole organ, and whole organism behavior. Addresses the impact on discovery, such as cellular function as implicated in human disease and translational medicine, for example in cancer diagnosis. Margarida M. Barroso is a Professor in the Department of Molecular and Cellular Physiology, Albany Medical College (Albany, New York). Xavier Intes is a Professor in the Biomedical Engineering Department and Co-Director of the Center for Modeling, Simulation and Imaging for Medicine (CeMSIM) at Rensselaer Polytechnic Institute (Troy, New York). This book is devoted to innovative applications of new imaging technologies and is organized into three main complementary parts. The first part is basic research for innovative medicine, the second is translational research for innovative medicine, and the third is new technology for innovative medicine. This book helps to understand innovative medicine and to make progress in its realization. The book introduces readers to the basic principle of optical imaging technologies. Focusing on human disease diagnostics using optical imaging methods, it provides essential information for researchers in various fields and discusses the latest trends in optical imaging. In recent decades, there has been a huge increase in imaging technologies and their applications in human diseases diagnostics, including magnetic resonance imaging, x-ray computed tomography, and nuclear tomographic imaging. This book promotes further developments to extend optical imaging to a wider range of disease diagnostics. It is a valuable resource for researchers and students in the field of biomedical optics, as well as for clinicians. This book summarizes the progress in studies of tuberculosis host-pathogen interactions from several perspectives: molecular microbiology, immunology, animal models, clinical studies, epidemiology, and drug discovery. Tuberculosis (TB) remains a severe global public health problem. Complex interactions between environmental, microbial and host factors lead to clinically relevant infections. Studies on bacterial virulence, host-genetic, and immunological factors contributing to the susceptibility to TB provide an ever-growing foundation of knowledge that is critical to finding new interventions. Studies of immune mechanisms against M. tuberculosis infection have identified immunological markers associated with specific phenotypes in the host, providing insight into how they may be used to augment current treatment strategies. Recent advances in diagnosis, therapeutics and vaccines, as well as basic research on biomedical optics, have shed light on the development of new directions for prevention, treatment and control of TB. Improved understanding of the interplay between the bacterium and host is a key component of reducing incidence worldwide. These are exciting times for the field of optical imaging of brain function. Rapid developments in theory and technology continue to considerably advance understanding of brain function. Reflecting changes in the field during the past five years, the second edition of In Vivo Optical Imaging of Brain Function describes state-of-the-art techniques and their applications for the growing field of functional imaging in the live brain using optical imaging techniques. New in the Second Edition: Voltage-sensitive dyes imaging in awake behaving animals Imaging based on genetically encoded probes Imaging of mitochondrial auto-fluorescence as a tool for cortical mapping Using pH-sensitive dyes Imaging of neuronal activity using 2-photon calcium imaging A new concept of the Fourier approach to optical imaging Fully updated chapters from the first edition Leading Authorities Explore the Latest Techniques Updated to reflect continuous development in this emerging research area, this new edition, as with the original, reaches across disciplines to review a variety of non-invasive optical techniques used to study activity in the living brain. Leading authorities from such diverse areas as biophysics, neuroscience, and cognitive science present a host
of perspectives that range from a single neuron to large assemblies of millions of neurons, captured at various temporal and spatial resolutions. Introducing techniques that were not available just a few years ago, the authors describe the theory, setup, analytical methods, and examples that highlight the advantages of each particular method. Biomedical optical imaging is a rapidly emerging research area with widespread fundamental research and clinical applications. This book gives an overview of biomedical optical imaging with contributions from leading international researchers who have pioneered new techniques and applications. A unique research field spanning the macroscopic to the microscopic, biomedical optical imaging allows both structural and functional imaging. Techniques such as confocal and multiphoton microscopy provide cellular level resolution imaging in biological systems. The integration of this technology with exogenous fluorophores can selectively enhance contrast for molecular targets as well as supply functional information on processes such as nerve transduction. Novel techniques integrate microscopy with state-of-the-art optics technology, and these include spectral imaging, two photon fluorescence correlation, nonlinear nanoscopy; optical coherence tomography techniques allow functional, dynamic, nanoscale, and cross-sectional visualization. Moving to the macroscopic scale, spectroscopic assessment and imaging methods such as fluorescence and light scattering can provide diagnostic pathology insights using living tissues and physiological systems. This means to explore processes which occur deep inside biological tissues and organs. The integration of these techniques with exogenous probes enables molecular specific sensitivity. Bioluminescence methods are gaining increased attention due to their sensitivity, selectivity, and simplicity, along with the fact that bioluminescence can be monitored both in vivo and in vitro. This book introduces bioluminescence and fluorescence systems, along with the principles of their application for in vivo imaging of intracellular processes, and covers recent developments in optical (bioluminescence and fluorescence) imaging in cell biology. This book is intended for scientists and students involved in basic cell physiology research, as well as industry professionals, engineers, and managers involved in drug discovery and pre-clinical drug development. It discusses the practical aspects of luminescence in vivo imaging for monitoring intracellular processes. While some basic knowledge of biochemistry and biophysics is preferable, the book includes a brief review of fundamental principles to allow those not familiar with these disciplines to grasp basic concepts. Pericytes were originally discovered and named more than hundred years ago as contractile cells around the blood vessel endothelial cells. Due to the lack of exclusive markers, pericytes are now defined by a combination of location, morphology and gene expression. Pericytes are attracting increasing attention as important regulators during development and during normal and disturbed organ function. In recent years, remarkable progress has been made in the identification and characterization of pericytes subpopulations and their amazing functions using state-of-art techniques. These advantages facilitated identification of molecular interaction pathways in the entire cell wall types, and the development of a comprehensive list of key signals derived from pericytes involved in homeostasis, regeneration, and disease regulation. In the last ten years, several unexpected roles of pericytes have been discovered. It has been demonstrated that pericytes from different tissues differ in their properties as well as functions. Even more, pericytes are heterogeneous also within the same organ. This book is will describe the major contributions of pericytes to different organs biology in physiological and pathological conditions. The book will teach the readers about this so special cell type that 10 years ago was almost completely forgotten, and it was associated basically only with vascular stability. Recently, it become a very hot topic to work in. Several articles in Nature, Science and Cell have been and are being currently published about this cell type. These recent works are revealing how important those cells are far before with unimaginable biological processes. Thus, this book will introduce to the young generation all the history about these cells from when they were discovered in different organs till where we are now in this field. So it will be a great book for both cell biology students as well as researchers that will have an update on these cells biology in different organs. The ability to visualize structural features of the brain and associated functional information has fueled a revolution in our understanding of the brain. The optical technique two-photon microscopy (2PM) is widely used to study individual neural circuits and blood vessel networks in vivo because it is minimally invasive and provides three-dimensional images with cellular resolution. There is rising interest from neuroscientists for the ability to extend the traditional imaging depth of 2PM to more than 1000 [micrometer]2 of the surface of the brain, and the field of two-photon microscopy is rapidly growing. In this dissertation, I detail the development of a novel laser source that enables deep-tissue in vivo multiphoton microscopy imaging of blood vessel networks and neurons. Using an excitation wavelength near 1,300 nm at which scattering in tissue is minimized, I demonstrate the ability to chronically study vascular morphology and dynamics as well as neuron morphology at imaging depths of 1 mm and beyond. An overview of the techniques used in modern neuroscience research with the emphasis on showing how different techniques can optimally be combined in the study of problems that arise at some levels of nervous system organization. This is essentially a working tool for the scientist in the laboratory and clinic, providing detailed step-by-step protocols with tips and recommendations. Most chapters and protocols are organized such that they can be used independently, while cross-references between the chapters, a glossary, a list of suppliers and apparatuses further help the reader. Surgical activity in the myocardium coordinates the contraction of the heart, and its knowledge could lead to a better understanding, diagnosis, and treatment of cardiac diseases. This electrical activity generates an electromagnetic field that propagates outside the heart and reaches the human torso surface, where it can be easily measured. Classical electrocardiography aims to interpret the 12-lead electrocardiogram (ECG) to determine cardiac activity and support the diagnosis of cardiac pathologies such as arrhythmias, altered activations, and ischemia. More recently, a higher number of leads is used to reconstruct a more detailed quantitative description of the electrical activity in the heart by solving the so-called inverse problem of electrocardiography. This technique is known as ECG imaging. Today, clinical applications of ECG imaging are showing promising results in guiding a variety of electrophysiological interventions such as catheter ablation of atrial fibrillation and ventricular tachycardia. However, in order to promote the adoption of ECG imaging in the routine clinical practice, further research is required regarding more accurate mathematical methods, further scientific validation under different preclinical scenarios and a more extensive clinical validation. Written by the founder of the field of carbon “quantum” dots (carbon dots) and related technology, this book outlines the principles of carbon dots and presents strong evidence for that small carbon nanoparticles and by extension carbon dots represent the nanoscale carbon allotrope at zero-dimension. Historical accounts of the inception and evolution of the carbon dots field are provided. Experimental approaches and techniques for the dot synthesis and some related major issues are discussed in detail. The photoexcited state properties, especially the bright and colorful photophysical characteristics of carbon dots are presented. Finally, a broad range of applications of carbon dots and their derived hybrid nanostructures in biomedical, renewable energy, food and environmental safety, and other technologies are highlighted. The book concludes with a discussion on the excellent potential and opportunities for further
concentration and also visualize exogenous contrast agents as well as molecular and functional markers. Indeed, in vivo engineered into the cyclotide loops, thus increasing the avidity of the peptide construct for its target. A major goal of in vivo displaying the targeting epitopes on small ~29 amino acid cyclic plant protein scaffolds known as cyclotides. Cyclotides are in vivo. Conversely, optical imaging is sensitive and offers good spatial resolution, but is not useful for deep tissue and offer deep tissue sensitivity. Radiolabeled peptides, however, often exhibit poor stability and high kidney uptake in applications that were not available just a few years ago, the authors describe the theory, setup, analytical methods, and examples that highlight the advantages of each particular method. Since the word microscopy was coined in 1656, the evolution of the instrument has had a long and convoluted history. Plagued with problems of chromatic aberration, spherical aberration, and challenges with illumination and resolution, the microscope’s technical progression happened in a series of fits and starts until the late 19th century. After EThe application of optical methods for investigating neocortical circuitry contains the timely expanded and key new insights into living systems. We have selected high affinity peptides that bind a specific carbohydrate-lectin complex involved in cell-cell adhesion and cross-linking using bacteriophage (phage) display technologies (1,2). These peptides have allowed us to probe the role of these antigens in cell-cell adhesion. Fluorescent spectroscopy diagnosis of breast cancer and atherosclerosisThe objective of this research is to develop phage display-selected peptides into radio- and fluorescently-labeled scaffolds for the multimodal imaging of carbohydrate-lectin interactions. While numerous protein and receptor systems are being explored for the development of targeted imaging agents, the targeting and analysis of carbohydrate-lectin complexes in vivo remains relatively unexplored. Antibodies, nanoparticles, and peptides are being developed that target carbohydrate-lectin complexes in living systems. However, antibodies and nanoparticles often suffer from slow clearance and toxicity problems. Peptides are attractive alternative vehicles for the specific delivery of radionuclides or fluorophores to sites of interest in vivo, although, because of their size, uptake and retention may be less than antibodies. We have selected high affinity peptides that bind a specific carbohydrate-lectin complex involved in cell-cell adhesion and cross-linking using bacteriophage (phage) display technologies (1,2). These peptides have allowed us to probe the role of these antigens in cell-cell adhesion. Fluorescent versions of the peptides have been developed for optical imaging and radiolabeled versions have been used in single photon emission computed tomography (SPECT) and positron emission tomography (PET) in vivo imaging (3-6). A benefit in employing the radiolabeled peptides in SPECT and PET is that these imaging modalities are widely used in living systems and offer deep tissue sensitivity. Radiolabeled peptides, however, often exhibit poor stability and high kidney uptake in vivo. Conversely, optical imaging is sensitive and offers good spatial resolution, but is not useful for deep tissue penetration and is quasi-quantitative. Thus, multimodality imaging that relies on the strengths of both radio- and optical-imaging is a current focus for development of new in vivo imaging agents. We propose a novel means to improve the efficacy of radiolabeled and fluorescently labeled peptides, including our lectin/carbohydrate- targeting peptides, by displaying the targeting epitopes on small ~29 amino acid cyclic plant protein scaffolds known as cyclotides. Cyclotides are extremely stable molecules with long serum half-lives and low kidney uptake (7). More than one copy of the peptide can be engineered into the cyclotide loops, thus increasing the avidity of the peptide construct for its target. A major goal of in vivo imaging is to obtain individualized structural, functional, and molecular information to provide personalized medicine. In vivo imaging using optical imaging can include functional information such as healthy and diseased tissue as well as penetration and visualization of endogenous and exogenous contrast agents. Indeed, in vivo optical imaging extends across a wide range of applications, from cellular to organ levels. At high end of the spectrum, diffuse optical tomography (DOT) can penetrate up to 10 centimeters but only offer low-resolution images (> 5mm) due to sharply scattering nature of the tissue. Significant effort has been spent on multi-modality imaging techniques to improve
the resolution of DOT. While combining DOT with spatial information defined by a separate anatomical imaging modality is promising, there are many challenges and inaccuracies that arise with co-registration. However this can be overcome with a novel multi-modality imaging technique, Photo-Magnetic Imaging (PMI) which uses MRI as a detector to provide both high resolution anatomical and optical information. PMI takes advantage of the 3D measurement capabilities of MR thermometry (MRT) to non-invasively measure the temperature increase of the medium induced by a laser to acquire a temperature map of the entire volume. As DOT measures the photon flux only from the boundary, the major advantage of PMI is that high absorbing regions can be resolved directly from the high spatial resolution temperature map. These measurements can then be converted to obtain the optical absorption properties of the tissue using a reconstruction algorithm to model the light propagation and heat transfer in tissue. This thesis will present the development of the first preclinical in vivo small animal PMI system prototype using the safety standards set by the American National Standard Institution. To optimize the system for in vivo studies, a fast PMI reconstruction method was also developed to accelerate the original PMI reconstruction method ~1000 times faster. These promising results validated the practicality of PMI for preclinical studies and showed the potential of PMI for clinical studies. This led to the development of the first human PMI prototype for clinical breast studies. This open access book provides a comprehensive overview of the application of the newest laser and microscope/ophthalmoscope technology in the field of high resolution imaging in microscopy and ophthalmology. Starting by describing High-Resolution 3D Light Microscopy with STED and RESOLFT, the book goes on to cover retinal and anterior segment imaging and image-guided treatment and also discusses the development of adaptive optics in vision science and ophthalmology. Using an interdisciplinary approach, the reader will learn about the latest developments and most up to date technology in the field and how these translate to a medical setting. High Resolution Imaging in Microscopy and Ophthalmology - New Frontiers in Biomedical Optics has been written by leading experts in the field and offers insights on engineering, biology, and medicine, thus being a valuable addition for scientists, engineers, and clinicians with technical and medical interest who would like to understand the equipment, the applications and the medical/biological background. Lastly, this book is dedicated to the memory of Dr. Gerhard Zinser, co-founder of Heidelberg Engineering GmbH, a scientist, a husband, a brother, a colleague, and a friend. To describe principles of optical imaging including chemistry and physics of fluorescence, limitations/advantages of optical imaging compared to metabolic and anatomic imaging. Describe hardware adapted for small animal imaging and for clinical applications: endoscopes and operative microscopes. Outline FDA approved and newer optical imaging probes. Include discussion of chemistry and linkage to other proteins. Review current techniques to image cancer and the development of techniques to specifically image cancer cells. Review use of exploiting differences in tissue autofluorescence to diagnose and treat cancer. Include agents such as 5-aminoleculinic acid. Review mechanisms that require proteolytic processing within the tumor to become active fluorophores. Review use of cancer selective proteins to localize probes to cancer cells: include toxins, antibodies, and minibodies. Introduction of plasmids, viruses or other genetic material may be used to express fluorescent agents in vivo. This chapter will review multiple vectors and delivery mechanisms of optical imaging cassettes. Preclinical investigations into the use of optical contrast agents for the detection of primary tumors in conventional and orthotopic models will be discussed. Preclinical investigations into the use of optical contrast agents for the detection of metastatic tumors in mouse models will be discussed. Use of targeted and non-specific optical contrast agents have been used for the detection of sentinel lymph node detection. These applications and how they differ from other applications will be discussed. Because of the unique difficulty of identifying tumor from normal tissue in brain tissue, a separate chapter would be needed. More clinical data is available for this cancer type than any other. Discussion of potential clinical applications for optical imaging and an assessment of the potential market. Optical Imaging Devices: New Technologies and Applications delivers a comprehensive introduction to optical imaging and sensing, from devices to system-level applications. Drawing upon the extensive academic and industrial experience of its prestigious editors and renowned chapter authors, this authoritative text: Explains the physical principles of optical imaging and sensing Covers topics such as silicon-based imaging characteristics, nanophotonic phased arrays, thin-film sensors, label-free DNA sensors, and in vivo flow cytometry. Presents the contributions of leading researchers, real-world examples from biomedicine, recommendations for further reading, and all measurements in SI units. Optical Imaging Devices: New Technologies and Applications provides an essential understanding of the design, operation, and practical applications of optical imaging and sensing systems, making it a handy reference for students and practitioners alike. Copyright code: 6654187987462f574f574bdd154a5818c16f