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Monoclonal Antibody and Peptide-Targeted Radiotherapy of Cancer *Monitoring and Predicting Response to Peptide Receptor Radionuclide Therapy* **Enhanced Peptide Radiotherapy of Prostate Cancer Using Targeted Adenoviral Vectors** Targeted Radionuclide Therapy **Practical Guidance on Peptide Receptor Radionuclide Therapy (PRRNT) for Neuroendocrine Tumors TIP-1, a New Biomarker for Radiotherapy, Regulates Migration and Invasion of Human Gliomas Through Rho GTPases Radionuclide Peptide Cancer Therapy Nanoparticle Enhanced Radiation Therapy** Development of GIPR Antagonistis for Targeted Ratiotheraphy in Neuroendocrine Neoplasms **Theranostics, Gallium-68, and Other Radionuclides** Targeted 177Lu Antisense Radiotherapy of B-cell Non-Hodgkin's Lymphoma **Structurally Diverse Cu-64-labeled RGD Peptide Conjugates for PET Imaging of [alpha]v[beta]3 Expression** *Melanoma Therapy with Rhenium-Cyclized Alpha Melanocyte Stimulating Hormone Peptide Analogs* **99mTc-Sestamibi** Rehenium Cyclized [alpha]-MSH Analogs, Somatostatin Analogs and

T-antigen Avid Peptides as Imaging and Therapeutic Agents for Tumor Targeting Medical Imaging for Health Professionals *Peptide Applications in Biomedicine, Biotechnology and Bioengineering* Epidermal Growth Factor Receptor Overexpression as a Target for Imaging and Radiotherapy of Breast Cancer **Pheochromocytoma (PHEO) and Paraganglioma (PGL) Nuclear Medicine Therapy Radiopharmaceuticals for Therapy Arsenic for Potential Diagnostic Imaging and Radiotherapy** Handbook of Radiopharmaceuticals **AACR 2016: Abstracts 2697-5293** Insights from Imaging in Bioinorganic Chemistry *Carbon-Ion Radiotherapy* Molecular Imaging in Oncology Peptide and Protein Engineering for Biotechnological and Therapeutic Applications **Therapeutic Nuclear Medicine Targeting the Bombesin Subtype 2 Receptor for the Diagnosis and Treatment of Metastatic Prostate Cancer Advances in Nuclear Oncology:** Handbook of Nuclear Chemistry Management of Neuroendocrine Tumors of the Pancreas and Digestive Tract **Radionuclide Therapy** Amino Acids, Peptide and Proteins **PET Chemistry** Harnessing Materials for X-ray Based Cancer Therapy and Imaging *Targeting Cancer with Antisense Oligomers Radiopharmaceutical Chemistry* **Somatostatin Analogues**

Offering lower toxicity and higher accuracy than conventional therapies, this source offers illustrative coverage of this new method to treat tumors associated with brain, breast, lung, and neuroendocrine cancers. Accompanied by a CD offering color images, radiolabeling procedures, and tips on radiopharmceutical administration, this source will off This book outlines some new advances in genetics, clinical evaluation, localization, therapy (newly including immunotherapy) of pheochromocytoma and paraganglioma including their metastatic

counterparts. Well-known and experienced clinicians and scientists contributed to this book to include some novel approaches to these tumors. This book will serve to various health care professionals from different subspecialties, but mainly oncologists, endocrinologists, endocrine surgeons, pediatricians, and radiologists. This book shows that the field of pheochromocytoma/paraganglioma is evolving and a significant progress has been made in last 5 years requiring that health care professionals and scientists will learns new information and implement it in their clinical practice or scientific work, respectively. This book should not be missed by anybody who is focusing on neuroendocrine tumors, their newest evaluation and treatment. Receptors predominantly expressed on tumor cells represent one of the key prerequisites of targeted radiotherapy. The gastric inhibitory polypeptide receptor (GIPR) has emerged as a promising target due to its substantial overexpression in neuroendocrine neoplasms (NENs) and virtual absence in healthy tissues (Waser 2012). So far, only radiolabeled peptides targeting the somatostatin receptor 2 (SSTR2) are approved for targeted radiotherapy of inoperable, metastatic NENs. The aim of this thesis was to develop highly affine GIPR tracers for targeted radiotherapy by continuous in vitro and in vivo characterization of peptide sequence modifications. It was hypothesized that a GIPR antagonist might increase the sensitivity to detect GIPR-positive tumors relative to the agonist GIP(1-30), as shown for SSTR2 tracers (Reubi 2017). Further comparison to the SSTR2 agonist and antagonist (DOTATATE, JR11) should allow compound ranking regarding their ability to detect NENs. The novel GIPR-targeting antagonists were conjugated to DOTA, enabling complexation of diagnostic (e. g. 111In) and therapeutic radionuclides (e. g. 177Lu). Among the high number of compounds screened, 3BP-3775 proved to be the most promising candidate for

further preclinical and clinical development. […]. An adenovirus encoding the genes for human somatostatin receptor subtype 2 has been constructed and evaluated in human prostate cancer cells with regard to binding of 64Cu-octreotide. In vitro experiments were performed with DU-145 and PC-3 human prostate cancer cells. Expression levels of SSTR2 were determined using a 64Cu-octreotide saturation binding assay on cell membrane preparations. In vivo experiments were conducted in scid mice bearing subcutaneous DU-l45 or PC-3 cells. AdSSTR2 was injected intratumorally followed 48 h later by an i.v. injection of 64Cu-octreotide. The mice were sacrificed 1 h after peptide injection for biodistribution analysis. The expression of SSTR2 on DU-145 cells was 9485 fmol/mg after infection at 100 MOl compared to 3540 fmol/mg on PC-3 cells. In vivo biodistribution studies showed similar uptake of 64Cu-octreotide in both DU-l45 and PC-3 tumors after infection with AdSSTR2 (2.5 and 2.7% ID/g, respectively). This uptake was greater than that observed in tumors injected with control adenovirus (1.4 - 1.6% ID/g). Written for researchers, academics and professionals, these papers represent an indispensable reference source on the latest trends and findings in the field of proteins, amino acids and peptides. A comprehensive, authoritative and up-to-date reference for the newcomer to radiopharmaceuticals and those already in the field. Radiopharmaceuticals are used to detect and characterise disease processes, or normal biological function, in living cells, animals or humans. Used as tracer molecules, they map the distribution, uptake and metabolism of the molecule in clinical studies, basic research or applied research. The area of radiopharmaceuticals is expanding rapidly. The number of PET centers in the world is increasing at 20% per year, and many drug companies are utilising PET and other forms of radiopharmaceutical imaging to evaluate

products. * Readers will find coverage on a number of important topics such as radionuclide production, PET and drug development, and regulations * Explains how to use radiopharmaceuticals for the diagnosis and therapy of cancer and other diseases * The editors and a majority of the contributors are from the United States Nuclear Medicine Therapy presents the state of the art in targeted radionuclide therapy, both in clinical practice and contemporary clinical investigation and trials. With contributions from an internationally-distinguished group of physicians and scientists, the book is devoted entirely to the use of nuclear medicine techniques and technology for therapy of malignant and benign diseases. Individual chapters cover the scientific principles and clinical applications of radionuclide therapy and the state of clinical trials of agents currently under investigation in the therapy of tumors involving virtually every organ system. Due to overlapping interest in techniques, indications, and clinical use, the development of radionuclide therapy attracts considerable input from other medical specialists whose collaboration is essential, including radiation and medical oncologists, hematologists, diagnostic radiologists, hepatologists, endocrinologists, and rheumatologists. And because radionuclide therapy is a rapidly evolving field of nuclear medicine, it is the aim of this volume to appeal to all specialists involved in targeted radionuclide therapy and to contribute to the standardization of the practice globally. Radioimmunotherapy, also known as systemic targeted radiation therapy, uses antibodies, antibody fragments, or compounds as carriers to guide radiation to the targets. It is a topic rapidly increasing in importance and success in treatment of cancer patients. This book represents a comprehensive amalgamation of the radiation physics, chemistry, radiobiology, tumor models, and clinical data for targeted

radionuclide therapy. It outlines the current challenges and provides a glimpse at future directions. With significant advances in cell biology and molecular engineering, many targeting constructs are now available that will safely deliver these highly cytotoxic radionuclides in a targeted fashion. A companion website includes the full text and an image bank. Personalized medicine employing patient-based tailor-made therapeutic drugs is taking over treatment paradigms in a variety of ?elds in oncology and the central nervous system. The success of such therapies is mainly dependent on ef?cacious therapeutic drugs and a selective imaging probe for identi?cation of potential responders as well as therapy monitoring for an early bene?t assessment. Molecular imaging (MI) is based on the selective and speci?c interaction of a molecular probe with a biological target which is visualized through nuclear, magnetic resonance, near infrared or other methods. Therefore it is the method of choice for patient selection and therapy monitoring as well as for speci?c e- point monitoring in modern drug development. PET (positron emitting tomography), a nuclear medical imaging modality, is ideally suited to produce three-dimensional images of various targets or processes. The rapidly increasing demand for highly selective probes for MI strongly pushes the development of new PET tracers and PET chemistry. ‘PET chemistry’ can be de?ned as the study of positron-emitting compounds regarding their synthesis, structure, composition, reactivity, nuclear properties and processes and their properties in natural and - natural environments. In practice PET chemistry is strongly in?uenced by the unique properties of the radioisotopes used (e. g. , half-life, che- cal reactivity, etc.) and integrates scienti?c aspects of nuclear-, organic-, inorganic- and biochemistry. Utilization of biologically active peptides as a radionuclide delivery system for cancer detection and treatment has proven to be

an effective approach in recent research. Three types of peptides, rhenium cyclized [alpha]-melanocyte stimulating hormone ([alpha]-MSH) analogs, somatostatin analogs and T-antigen avid peptides have been synthesized and evaluated as potential peptide radiopharmaceuticals for cancer targeting in this thesis. Rhenium cyclized [alpha]-MSH is a novel metallopeptide that exhibits high melanoma uptake and retention and quick clearance from normal tissue. To expand its ability for targeting with a wider variety of radionuclides for melanoma imaging and therapy purposes, several rhenium cyclized [alpha]-MSH derivatives were synthesized, radiolabeled with different radionuclides (e.g., In-111, I-125), and evaluated in vitro and in vivo. Among these analogs, [superscript 111] In-DOTA-ReCCMSH(Arg [superscript 11]) showed high melanoma uptake and low background activity, which justified its radiolabeling with metallic radionuclides for further investigation as potential imaging and therapeutic radiopharmaceuticals. Ac-d-Lys-([superscript 125] I-IBA)-ReCCMSH(Arg [superscript 11]) exhibited remarkably high tumor uptake, enhanced cellular retention and low background in normal tissues. These observations demonstrated that Ac-d-Lys-ReCCMSH(Arg [superscript 11]) is an excellent candidate for the development of radiohalogenated peptides for melanoma radioimaging/radiotherapy. Since the incorporation of "unnatural" rhenium or technetium into peptides generated metal cyclized peptides with favorable properties, several rhenium/technetium cyclized somatostatin analogs were designed to target receptors on somatostatin receptor positive tumors. 1D and 2D NMR (TOCSY, ROESY, and NOESY) and mass spectrometry studies were used to determine the metal coordination sites in the complexes using nonradioactive rhenium. The results demonstrated that rhenium core in ReOTS1-pk1 were coordinated by three thiolate

sulfurs from Cys [superscript 5, 6, 12] and one amide nitrogen from Cys [superscript 6]. Molecular dynamic studies using computer modeling predicted these analogs would possess high binding affinities with somatostatin receptors and the stability of these complexes would have the relative ranking of TcTS1> TcTS2> TcTS3> TcTS4, which was verified by stability studies. These results illustrated that these metalated analogs were potential somatostatin receptor-positive tumor targeting peptides. T-antigens present on many types of tumor cells. Several T-antigen specific peptides were derivatized with the amino acid sequence Ac-CGC(G) for labeling with technetium-99m. The peptides were readily labeled in high yield, and the radiolabeled peptides possessed good stability. In vivo biodistribution studies demonstrated that the aromatic rich peptides had high liver uptake and slow clearance, while the modified shorter peptides exhibited lower liver uptake and an improved biodistribution profile. 99mTc-sestamibi is a single-photon emission computed tomography (SPECT) radiotracer that is widely used for the imaging of myocardial perfusion, as well as a variety of malignant and benign diseases. 99mTc-Sestamibi – Clinical Applications provides a detailed and informative overview of almost all the oncologic and non-oncologic applications of 99mTc-sestamibi SPECT, including several relatively rare indications. Different disease-related protocols for 99mTc-sestamibi SPECT are presented, and for each disease a comprehensive summary of the relevant pathology and epidemiology is provided. Throughout, there is a strong emphasis on the practical aspects of use of this popular tracer, including instructions for the preparation of several commercially available tracer kits. Clinical practitioners will find this book to be an invaluable guide to the application and benefits of 99mTc-sestamibi SPECT in both the inpatient and the outpatient setting. Featuring chapters

from specialists in endocrinology, physiology, pathology, and nuclear medicine, this book provides a multidisciplinary approach to a wide variety of issues concerning somatostatin and its analogues. The book: Provides the most up-to-date coverage of somatostatin analog use in diagnostic and therapy Integrating the specialties of endocrinology, physiology, pathology, and nuclear medicine, providing the multidisciplinary approach to the topic Focuses on future applications, novel compounds, and areas for further research Covers topics by authors who are renowned experts and researchers in the field The B-cell lymphoma/leukemia-2 (bcl-2) proto-oncogene in non-Hodgkin's lymphoma (NHL) is a dominant inhibitor of apoptosis. The research goal was to develop a 177Lu-labeled bcl-2 antisense peptide nucleic acid (PNA)-peptide conjugate designed for dual modality NHL therapy, consisting of a radiopharmaceutical capable of simultaneously down-regulating apoptotic resistance and delivering cytotoxic internally emitted radiation. In vitro results demonstrated 177Lu-DOTA-anti-bcl-2-Tyr3-octreotate uptake in Mec-1 NHL cells. An in vitro dosimetry model was generated with the resulting data. Proliferation and viability assays of mass and absorbed dose indicated a mass-dose dependence and that 177Lu-bcl-2 antisense PNA-Tyr3-octreotate acted additively in effecting decreased cell viability with increasing radiation doses. In vivo receptor saturation studies determined the mass of the compound necessary to saturate tumors, providing maximal compound uptake and antisense potential. Biodistribution data showed specific tumor targeting of the radiolabeled PNA-peptide in Mec-1 xenografts, which was compared to the radiolabeled peptide 177Lu-DOTA-Tyr3-octreotate. In vivo dosimetry modeling calculated normalized tumor absorbed doses that would be below the 2 Gy bone marrow margin of safety. Therapy studies showed modest tumor growth delay for

treatment with the 177Lu-labeled PNA peptide. A comparison of the efficacy of a pulse/chase injection versus a single injection of the compound is also discussed. With molecular imaging becoming one the fastest growing topics in medical schools, Informa Healthcare presents Molecular Imaging in Oncology, the first comprehensive reference on molecular imaging in oncology.Giving clinicians and researchers a greater understanding of the current field, this text covers:instrumentation and techniquescancer imaging Peptide Applications in Biomedicine, Biotechnology and Bioengineering summarizes the current knowledge on peptide applications in biomedicine, biotechnology and bioengineering. After a general introduction to peptides, the book addresses the many applications of peptides in biomedicine and medical technology. Next, the text focuses on peptide applications in biotechnology and bioengineering and reviews of peptide applications in nanotechnology. This book is a valuable resource for biomaterial scientists, polymer scientists, bioengineers, mechanical engineers, synthetic chemists, medical doctors and biologists. Presents a self-contained work for the field of biomedical peptides Summarizes the current knowledge on peptides in biomedicine, biotechnology and bioengineering Covers current and potential applications of biomedical peptides This book discusses the efficacy of nanomaterial-based X-rays enhancers against cancer therapy and imaging in both in vitro and in vivo systems. Also, synthesis, mechanism, and the related biological effects are given. Moreover, nanoparticle-based contrast agents to enhance the image quality are compiled. Finally, special nanoparticle-based contrast agents to enhance the contrast for targeted cancer therapy are covered and discussed. The overexpression of the epidermal growth factor receptor in 30-60% of human breast cancers was investigated as a target for radiopharmaceuticals specifically

directed against the receptor for diagnostic imaging and radiotherapy of the disease. Using phantoms (models) of breast cancer lesions targeted ' in vitro' with indium-111 labelled human epidermal growth factor (111In-hEGF), it was demonstrated that diagnostic imaging through targeting EGFR overexpression in breast cancer could be a very sensitive technique able to detect as few as 5 * 104 to 105 cancer cells under ideal conditions. The sensitivity was reduced up to 300-fold however by receptor heterogeneity or a low proportion of tumour cell targeting combined with tissue attenuation. A comparison of the tumour imaging properties of 111In-hEGF and 111In-labelled anti-EGFR monoclonal antibody 528 (111In-mAb 528) in athymic mice with human breast cancer xenografts showed that macromolecules are more effective tumour targeting agents than peptide growth factors due to higher absolute tumour uptake at only slightly lower tumour/blood ratios. The 10-fold higher tumour uptake of 111In-mAb 528 compared to 111In-hEGF was likely due to its prolonged residence time in the blood. The internalization and nuclear translocation of 111In-hEGF after binding to its receptor was exploited to selectively deliver 111In into the cytoplasm and nucleus of breast cancer cells overexpressing the EGFR. Internalized 111In-hEGF was radiotoxic 'in vitro' to the breast cancer cells with This book provides detailed information on therapeutic radiopharmaceuticals and discusses emerging technologies which have potential for broad clinical implementation. Recent advances in molecular biology, radiopharmaceutical chemistry and radioisotope production have stimulated a new era for the use of radiopharmaceuticals for targeted radionuclide therapy (TRT). Emerging clinical trials include use of peptides and monoclonal antibodies radiolabeled with therapeutic radionuclides for cancer therapy. In addition, small molecules are used for the treatment of

chronic diseases such as metastatic bone pain palliation and radiation synovectomy of inflammatory joints. In the interventional arena, therapy of primary and metastatic liver cancer and arterial restenosis following angioplasty of both the coronary and peripheral arteries are being explored. Reactor and accelerator production of therapeutic radioisotopes is also integrated into these discussions. The development and use of radiopharmaceutical targeting characteristics required for treatment of specific disease processes and how these are implemented for radiopharmaceutical design strategies are also described. Radiopharmaceuticals for Therapy will benefit audiences in nuclear medicine and radionuclide therapy and will thus prove an invaluable source of up-to-date information for students, radiopharmaceutical scientists and professionals working in the radiopharmacy and nuclear medicine specialties. This book pursues a multidisciplinary approach, presenting chapters with updated information on various aspects of treatment for patients with neuroendocrine tumors. Authors have been selected from expert centers in Europe and the United States. The goal of this book is to comprehensively summarize recent data and provide inspiring ideas to optimize the care of patients with neuroendocrine tumors. Neuroendocrine tumors are fascinating multifaceted diseases that can primarily localize in many organs with various presentations. These tumors are rare but their increasing incidence renders likely that physicians caring for cancers may have either already faced or may be certainly exposed to diagnose and/or treat a patient with neuroendocrine tumors. Over the last years, novel therapeutic options have emerged for neuroendocrine tumors, profoundly challenging practices that had previously been the standards for decades. These include - but are not limited to - somatostatin analogues, targeted therapies such as tyrosine kinase and mTOR inhibitors,

antiangiogenic compounds, but also peptide-receptor targeted therapy or radioembolization. This changing field has generated novel treatment algorithms to guide medical decisions. To better understand and handle the multidisciplinary approaches that are required for optimizing the care of neuroendocrine tumor patients, physicians are now looking for references from experts and comprehensive reviews summarizing current knowledge on treatments for patients with neuroendocrine tumors. Improved targeting of abnormal cells and tissue in the radiotherapy of cancer has been a long-standing goal of researchers. The central purpose of nanoparticle-enhanced radiotherapy (NPRT) is to more precisely control where the radiation dose is delivered, desirably with subcellular precision, provided we can find a method to bring the nanoparticles to target as well as control their concentration and size distribution. The contents within this book will cover the rationale and fundamental principles of NPRT, optimal nanoparticle sizes, concentrations, design and fabrication, effective nanoparticle delivery methods, emerging clinical applications of NRT modalities, treatment planning and quality assurance and the potential of NPRT in global health. This volume will serve as a resource for researchers, educators and industry, and as a practical guide or comprehensive reference for students, research trainees and others working in cancer nanomedicine. Key Features Covers the most important advances in nanoparticle-aided radiation therapy over the last few decades Features contributions from leaders in the field Focuses first on the fundamentals of radiosensitization, then it continues with imaging methods and concludes with various clinical applications In the United States, prostate cancer is the most commonly diagnosed cancer and the third leading cause of cancer related deaths in men. With early detection, definitive therapeutic options can provide a

cure. However, undetected extracapsular or regional lymph node metastasis plagues the long-term survival statistics of definitive therapies. In advanced prostate cancer, initial androgen depravation therapy has failed to control cancer progression, and regional lymph node and distant osseous metastasis are common. With metastatic spread, prostate cancer remains incurable. Aberrant expression of the bombesin subtype 2 receptor (BB2r) is present on over 80% of human prostate cancer tissues evaluated. The BB2r binds with high affinity to the bombesin peptide (BBN), stimulating agonist mediated receptor-peptide internalization into the cancer cell. Accordingly, targeting the BB2r with radioisotopes conjugated to BBN represents a promising method for diagnostic and therapeutic radiopharmaceutical development for metastatic prostate cancer. The results of this research demonstrate the potential diagnostic capabilities of BB2r targeted compounds. We also demonstrate a potential mechanism of therapeutic effect while optimizing administration timing, and evaluate the therapeutic potential of BB2r targeted radiotherapy administered with FDA approved, radiosensitizing chemotherapeutics for the treatment of metastatic prostate cancer. Taken together, BB2r targeted radiopharmaceuticals have the potential to fill a well known clinical need for the diagnosis and treatment of metastatic prostate cancer in human patients. Malignant melanoma is the 6th most commonly diagnosed cancer with increasing incidence in the United States. It is estimated that 54,200 cases of malignant melanoma will be newly diagnosed and 7,600 cases of death will occur in the United States in the year 2003 (1). At the present time, more than 1.3% of Americans will develop malignant melanoma during their lifetime (2). The average survival for patients with metastatic melanoma is about 6-9 months (3). Moreover, metastatic melanoma deposits are

resistant to conventional chemotherapy and external beam radiation therapy (3). Systematic chemotherapy is the primary therapeutic approach to treat patients with metastatic melanoma. Dacarbazine is the only single chemotherapy agent approved by FDA for metastatic melanoma treatment (5). However, the response rate to Dacarbazine is only approximately 20% (6). Therefore, there is a great need to develop novel treatment approaches for metastatic melanoma. The global goal of this research program is the rational design, characterization and validation of melanoma imaging and therapeutic radiopharmaceuticals. Significant progress has been made in the design and characterization of metal-cyclized radiolabeled alpha-melanocyte stimulating hormone peptides. Therapy studies with 188Re-CCMSH demonstrated the therapeutic efficacy of the receptor-targeted treatment in murine and human melanoma bearing mice (previous progress report). Dosimetry calculations, based on biodistribution data, indicated that a significant dose was delivered to the tumor. However, 188Re is a very energetic beta-particle emitter. The longer-range beta-particles theoretically would be better for larger tumors. In the treatment of melanoma, the larger primary tumor is usually surgically removed leaving metastatic disease as the focus of targeted radiotherapy. Isotopes with lower beta-energies and/or shorter particle lengths should be better suited for targeting metastases. The 177Lu-DOTA-Re(Arg11)CCMSH and 212Pb-DOTA-Re(Arg11)CCMSH complexes were developed and synthesized to investigate its ability to target and deliver an effective dose to small melanoma tumors and metastatic deposits. Dosimetry calculations for 188Re-CCMSH and 212Pb/212Bi[DOTA]-Re(Arg11)CCMSH were compared in the B16/F1 mouse melanoma flank tumor model to analyze the delivered dose to tumor and normal organs. Insights from Imaging in Bioinorganic Chemistry

continues a long-running series that describes recent advances in scientific research, in particular, in the field of inorganic chemistry. Several highly regarded experts, mostly from academe, contribute on specific topics. The series editor chooses a sub-field within inorganic chemistry as the theme and focus of the volume, extending invitations to experts for their contributions; the current theme is insights from metal ion imaging in bioinorganic and medicinal chemistry. Contains concise, informative accounts that are not too highly specialized, therefore appealing to a wide range of scientists and health professionals Presents contributions from highly qualified international experts Provides intrinsic scientific interest and applications, including important issues relating to the diagnosis and therapeutics that are relevant to public health The recent revolution in molecular biology offers exciting new opportunities for targeted radionuclide therapy. This up-to-date, comprehensive book, written by world-renowned experts, discusses the basic principles of radionuclide therapy, explores in detail the available treatments, explains the regulatory requirements, and examines likely future developments. The full range of clinical applications is considered, including thyroid cancer, hematological malignancies, brain tumors, liver cancer, bone and joint disease, and neuroendocrine tumors. The combination of theoretical background and practical information will provide the reader with all the knowledge required to administer radionuclide therapy safely and effectively in the individual patient. Careful attention is also paid to the role of the therapeutic nuclear physician in coordinating a diverse multidisciplinary team, which is central to the safe provision of treatment. "This book guides pharmacy and health researchers and professionals to understand and interpret medical imaging technology. Divided into two sections, coverage features both fundamental principles and clinical

applications. It describes the most common imaging tools - X-ray, CT, ultrasound, MRI, SPECT, and PET - and their use to diagnose common diseases that include heart, cancer, and lung. In addition, the authors introduce the emerging role of molecular imaging in the management of cancer and selection of patients for personalized treatments. The book features many illustrations and provides patient case examples of imaging applications to diagnose disease or monitor therapy"--Provided by publisher. This publication provides comprehensive, multidisciplinary guidance on the use of peptide receptor radionuclide therapy (PRRNT) in the treatment of patients with neuroendocrine tumours (NETS) and gastroenteropancreatic cancers, taking into account the recent international classification of NETs. It provides comprehensive protocols for employing 90Y or 177LU tagged somatostatin receptor targeting peptides as well as clinically assessed protocols for renal protection. It provides comprehensive, evidence based clinical guidelines, with input from experienced and renowned medical professional in the field. The various sections of the book cover clinical presentation, patient eligibility criteria and means of assessing the effectiveness of therapy using molecular and morphological medical imaging techniques. Book jacket. This revised and extended 6 volume handbook set is the most comprehensive and voluminous reference work of its kind in the field of nuclear chemistry. The Handbook set covers all of the chemical aspects of nuclear science starting from the physical basics and including such diverse areas as the chemistry of transactinides and exotic atoms as well as radioactive waste management and radiopharmaceutical chemistry relevant to nuclear medicine. The nuclear methods of the investigation of chemical structure also receive ample space and attention. The international team of authors consists of scores of world-renowned experts - nuclear chemists,

radiopharmaceutical chemists and physicists - from Europe, USA, and Asia. The Handbook set is an invaluable reference for nuclear scientists, biologists, chemists, physicists, physicians practicing nuclear medicine, graduate students and teachers - virtually all who are involved in the chemical and radiopharmaceutical aspects of nuclear science. The Handbook set also provides further reading via the rich selection of references. This book is a comprehensive guide to radiopharmaceutical chemistry. The stunning clinical successes of nuclear imaging and targeted radiotherapy have resulted in rapid growth in the field of radiopharmaceutical chemistry, an essential component of nuclear medicine and radiology. However, at this point, interest in the field outpaces the academic and educational infrastructure needed to train radiopharmaceutical chemists. For example, the vast majority of texts that address radiopharmaceutical chemistry do so only peripherally, focusing instead on nuclear chemistry (i.e. nuclear reactions in reactors), heavy element radiochemistry (i.e. the decomposition of radioactive waste), or solely on the clinical applications of radiopharmaceuticals (e.g. the use of PET tracers in oncology). This text fills that gap by focusing on the chemistry of radiopharmaceuticals, with key coverage of how that knowledge translates to the development of diagnostic and therapeutic radiopharmaceuticals for the clinic. The text is divided into three overarching sections: First Principles, Radiochemistry, and Special Topics. The first is a general overview covering fundamental and broad issues like “The Production of Radionuclides” and “Basics of Radiochemistry”. The second section is the main focus of the book. In this section, each chapter’s author will delve much deeper into the subject matter, covering both well established and state-of-the-art techniques in radiopharmaceutical chemistry. This section will be divided according to radionuclide and will include chapters on

radiolabeling methods using all of the common nuclides employed in radiopharmaceuticals, including four chapters on the ubiquitously used fluorine-18 and a “Best of the Rest” chapter to cover emerging radionuclides. Finally, the third section of the book is dedicated to special topics with important information for radiochemists, including “Bioconjugation Methods,” “Click Chemistry in Radiochemistry”, and “Radiochemical Instrumentation.” This is an ideal educational guide for nuclear medicine physicians, radiologists, and radiopharmaceutical chemists, as well as residents and trainees in all of these areas. The main purpose of this book is to create a reference for the indications, contraindications, patient selection, treatment practice, treatment side effect management, and follow-up of radionuclide treatments. Besides standard methods such as surgery, chemotherapy, radiotherapy, and hormone therapy, newly developed biological treatments, targeted treatments, personalized treatments, external beam radiotherapy, and targeted radionuclide treatments have begun to take their place in professional practice. Nuclear medicine, in addition to its role as a tracer of cancer, also assumes the role of treating with radioactive molecules directed to the cancer it traces. These traceable next-generation radionuclide treatments, whose efficacy and reliability have been proven and where diagnosis, treatment, and follow-up are carried out together, are increasingly included in oncology practice together with the new developed radiopharmaceuticals, ensuring a high rate of damage to cancer cells while protecting the surrounding normal tissues. Molecular cancer treatment will become more effective with individualized next-generation traceable radionuclide treatments, which will be shaped by genetic studies in the future. Radionuclide treatments for many cancer types and benign diseases are presented by experienced nuclear

medicine experts in the light of their own experience and case studies, while systemic treatments in common cancer types and side effect management of these treatments are summarized by medical oncologists. This book will be of interest to nuclear medicine physicians as well as oncologists. This book is based on contributions presented at the 1st World Congress on Gallium-68 and Peptide Receptor Radionuclide Therapy, which examined recent developments in theranostics – the emerging field of molecular targeting of vectors that can be used for both diagnosis and therapy, when modified accordingly. The focus of this book is on the rapidly developing research into and clinical applications of gallium-68 and other generator-produced PET radionuclides in the personalized diagnosis and treatment of neuroendocrine tumors and other diseases. In addition, new PET radiopharmaceuticals are considered, and the latest ideas and concepts, presented. Theranostics embodies both molecular and personalized medicine. It is at the cutting edge of medicine, and the contents of this volume will be of interest to chemists, physicians, and investigators dealing with generators, PET radiochemistry, molecular imaging, and radionuclide therapy. With financial assistance from the Department of Energy, we have shown definitively that radiolabeled antisense DNAs and other oligomers will accumulate in target cancer cells in vitro and in vivo by an antisense mechanism. We have also shown that the number of mRNA targets for our antisense oligomers in the cancer cell types that we have investigated so far is sufficient to provide and antisense image and/or radiotherapy of cancer in mice. These studies have been reported in about 10 publications. However our observation over the past several years has shown that radiolabeled antisense oligomers administered intravenously in their native and naked form will accumulate and be retained in target xenografts by an antisense

mechanism but will also accumulate at high levels in normal organs such as liver, spleen and kidneys. We have investigated unsuccessfully several commercially available vectors. Thus the use of radiolabeled antisense oligomers for the imaging of cancer must await novel approaches to delivery. This laboratory has therefore pursued two new paths, optical imaging of tumor and Auger radiotherapy. We are developing a novel method of optical imaging tumor using antisense oligomers with a fluorophore is administered while hybridized with a shorter complementary oligomer with an inhibitor. In culture and in tumored mice that the duplex remains intact and thus nonfluorescent until it encounters its target mRNA at which time it dissociates and the antisense oligomer binds along with its fluorophore to the target. Simultaneous with the above, we have also observed, as have others, that antisense oligomers migrate rapidly and quantitatively to the nucleus upon crossing cell membranes. The Auger electron radiotherapy path results from this observation since the nuclear migration properties could be used effectively to bring and to retain in the nucleus an Auger emitting radionuclide such as 111In or 125I bound to the antisense oligomer. Since the object becomes radiotherapy rather than imaging, the delivery problem may be obviated by attaching the antisense oligomer to an antitumor antibody to improve delivery following intravenous administration. Since many antibodies are trapped in endosomes following internalization, a cell penetrating peptide such as tat will also be included to ensure transport of the complex without entrapment. Rather than covalent conjugation of the three entities, we are using streptavidin as linker after biotinylated each component. Our recent efforts have concentrated on establishing the influence of the streptavidin linker on the properties of each component within the delivery nanoparticle. Thus, we have shown that the Herceptin

antibody, when linked to a labeled oligomer via streptavidin, remains capable of directing the label oligomer to Her2+ tumor cells in vitro and Her2+ tumor xenografts in mice. In addition, we have demonstrated that a labeled antisense oligomer within the nanoparticle remains capable of migrating to the nucleus and binding to its target mRNA in vitro and in vivo. We have shown that the tat peptide also preserves its properties of cell transport when incubated as one component of the nanoparticle. Most recently, we have addressed another of our concerns, namely whether the streptavidin would adversely effect the biodistribution of the antisense oligomer. We were pleased to find that the 99mTc-labeled antisense MORF within the Herceptin three component and two component nanoparticles accumulated and was retained in tumor in a manner suggestive of radiolabeled Herceptin itself. Thus the preserved properties within the streptavidin delivery nanoparticle of the Herceptin antibody, the tat peptide and the 111In labeled antisense MORF oligomer will explain why we have successfully demonstrated an Auger electron-mediated, antisense-mediated radiotherapy in cells in culture. One remaining concern is that the delivery nanoparticle may deliver the Auger electron emitting radionu ... Targeted agents hold promise for non-invasive in vivo imaging, therapy, and monitoring of diseases. Foundational work focused on imaging and therapy of cancer has centered primarily on the use of 18F, 90Y, 99mTc, and 131I radionuclides. Use of these agents often requires conjugation to a biological targeting vector, a peptide or monoclonal antibody, to investigate biological processes. However, to truly be effective, the physical properties of the radionuclide must be suitably matched to the time required for chemical derivatization, and conjugation, to reach maximal uptake of the targeting vector at the targeting site. Radioisotopes of arsenic, 72, 77As, have sufficiently long halflives that are well-matched

for conjugation to these biological targeting vectors. Even with favorable decay characteristics, production, and separation pathways, the ability to use radioarsenic has largely remained undeveloped. It is the aim of this work to address this issue through the identification and synthesis of no-carrier added radioarsenic complexes. Macroscopic synthesis of AsPh(S-Rn-S) precursors to no-carrier added 72,77AsPh(S-Rn-S) complexes, synthesis and no-carrier added radioarsenic labelling of a simple trithiol ligand, and synthesis of two linkable trithiocyanate precursors, a carboxylic acid, and “clickable” alkyne, are described in detail. Other topics that will be discussed in brief and can be found in the attached appendices are as follows: initial development of a radiochemical separation procedure to separate no-carrier arsenic, 77As, from a neutron irradiated germanium dioxide target, the initial evaluation of a novel copper selective resin, and synthesis of any additional compounds not mentioned in the chapters. Oncology Book of 2011, British Medical Association's Medical Book Awards Awarded first prize in the Oncology category at the 2011 BMA Medical Book Awards, Monoclonal Antibody and Peptide-Targeted Radiotherapy of Cancer helps readers understand this hot pharmaceutical field with up-to-date developments. Expert discussion covers a range of diverse topics associated with this field, including the optimization of design of biomolecules and radiochemistry, cell and animal models for preclinical evaluation, discoveries from key clinical trials, radiation biology and dosimetry, and considerations in regulatory approval. With chapters authored by internationally renowned experts, this book delivers a wealth of information to push future discovery. The AACR Annual Meeting is a must-attend event for cancer researchers and the broader cancer community. This year's theme, "Delivering Cures Through Cancer Science," reinforces the inextricable link between research

and advances in patient care. The theme will be evident throughout the meeting as the latest, most exciting discoveries are presented in every area of cancer research. There will be a number of presentations that include exciting new data from cutting-edge clinical trials as well as companion presentations that spotlight the science behind the trials and implications for delivering improved care to patients. This book contains abstracts 2697-5293 presented on April 19-20, 2016, at the AACR Annual Meeting. This book serves as a practical guide for the use of carbon ions in cancer radiotherapy. On the basis of clinical experience with more than 7,000 patients with various types of tumors treated over a period of nearly 20 years at the National Institute of Radiological Sciences, step-by-step procedures and technological development of this modality are highlighted. The book is divided into two sections, the first covering the underlying principles of physics and biology, and the second section is a systematic review by tumor site, concentrating on the role of therapeutic techniques and the pitfalls in treatment planning. Readers will learn of the superior outcomes obtained with carbon-ion therapy for various types of tumors in terms of local control and toxicities. It is essential to understand that the carbon-ion beam is like a two-edged sword: unless it is used properly, it can increase the risk of severe injury to critical organs. In early series of dose-escalation studies, some patients experienced serious adverse effects such as skin ulcers, pneumonitis, intestinal ulcers, and bone necrosis, for which salvage surgery or hospitalization was required. To preclude such detrimental results, the adequacy of therapeutic techniques and dose fractionations was carefully examined in each case. In this way, significant improvements in treatment results have been achieved and major toxicities are no longer observed. With that knowledge, experts in relevant fields expand upon techniques for treatment delivery at each

anatomical site, covering indications and optimal treatment planning. With its practical focus, this book will benefit radiation oncologists, medical physicists, medical dosimetrists, radiation therapists, and senior nurses whose work involves radiation therapy, as well as medical oncologists and others who are interested in radiation therapy. The diagnostic and therapeutic achievements in radiopharmaceuticals and nuclear medicine instrumentation – PET, SPECT, MR, CT and their hypbrids PET-CT and SPECT-CT – are the result of the interdisciplinary research efforts of cell-biologists, chemists, pharmacologists, physicists, computer-scientists, engineers, nuclear medicine physicians, and oncologists. The clinical implications of these achievements have made nuclear medicine indispensable in the management of cancer. This superbly illustrated text on modern nuclear medicine applications in the diagnosis and treatment of cancer describes the state of the art and the current position of nuclear medicine in the light of these recent developments. It is intended as a valuable update also for non-nuclear medicine specialists working in oncology. Nuclear medicine as part of molecular imaging and therapy has changed radically in the last decade. The growing importance and clinical impact of these changes in the near future has impelled the internationally renowned editors and contributors to put them on record in Advances in Nuclear Oncology.