

alternating electric field therapy glioblastoma

Alternating Electric Field Therapy for Glioblastoma: A Comprehensive Overview

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Publisher: Oxford University Press, a leading academic publisher with extensive experience in medical and scientific publications.

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Keywords: alternating electric field therapy glioblastoma, glioblastoma treatment, tumor treatment, electric field therapy, cancer therapy, non-invasive cancer treatment, glioblastoma research, AEF therapy, AEF glioblastoma, novel cancer therapies.

Abstract:

Glioblastoma (GBM) is an aggressive and highly lethal brain cancer with a dismal prognosis. Current treatment modalities, including surgery, radiotherapy, and chemotherapy, offer limited efficacy. Alternating electric field therapy (AEFT) represents a promising adjuvant therapy for GBM, offering a non-invasive approach to impede cancer cell proliferation and enhance the effectiveness of existing treatments. This article provides a comprehensive overview of alternating electric field therapy glioblastoma, exploring different methodologies, clinical applications, and future directions in research.

1. Understanding Glioblastoma and the Need for Novel Therapies

Glioblastoma multiforme (GBM) is the most common and aggressive primary malignant brain tumor in adults. Its highly invasive nature, coupled with its

resistance to conventional therapies, results in a median survival time of only 12-18 months. The current standard of care involves maximal safe surgical resection, followed by radiotherapy and chemotherapy with temozolomide. However, even with this multi-modal approach, recurrence is almost inevitable, highlighting the critical need for novel therapeutic strategies.

2. The Mechanism of Action of Alternating Electric Field Therapy (AEFT)

Alternating electric field therapy glioblastoma leverages the principle of applying low-intensity, alternating electric fields to disrupt the process of cell division within tumor cells. The mechanism isn't fully understood, but it's believed that the electric fields interfere with the mitotic spindle, a crucial structure responsible for accurate chromosome segregation during cell division. This interference leads to mitotic catastrophe and subsequent cell death, preferentially targeting rapidly dividing cancer cells. Importantly, healthy cells, which divide at a much slower rate, are less susceptible to the effects of AEF therapy.

3. Methodologies and Approaches in AEF Therapy for Glioblastoma

Several methodologies are employed in delivering AEF therapy for glioblastoma:

Transcranial AEF Therapy: This non-invasive approach involves placing electrodes on the scalp, allowing the electric field to penetrate the skull and reach the tumor site. This method is generally well-tolerated and minimizes the risk of surgical complications.

Intracranial AEF Therapy: This approach involves placing electrodes directly within the brain, either during surgery or via minimally invasive procedures. While offering more targeted delivery of the electric field, it carries a higher risk of complications associated with brain surgery.

Combined Modalities: Increasingly, research focuses on combining AEF therapy with other treatment modalities such as radiotherapy and chemotherapy. Preclinical studies suggest that AEF therapy can enhance the efficacy of these conventional treatments by sensitizing tumor cells and preventing the development of drug resistance. This combination approach represents a significant area of investigation in alternating electric field therapy glioblastoma research.

Optimization of Waveforms: The frequency and amplitude of the alternating electric field are crucial parameters influencing its effectiveness. Ongoing research is focused on optimizing these parameters to maximize tumor cell death while minimizing adverse effects on healthy brain tissue.

4. Clinical Trials and Outcomes in Alternating Electric Field Therapy Glioblastoma

Several clinical trials have evaluated the efficacy and safety of AEF therapy in patients with GBM. These trials have generally demonstrated promising results, showing an improvement in overall survival and progression-free survival when AEF therapy is used as an adjuvant treatment. While the results are encouraging, larger, multicenter trials are needed to confirm these findings and establish the optimal treatment parameters for alternating electric field therapy glioblastoma.

5. Challenges and Future Directions in AEF Therapy

Despite the promise of AEF therapy, several challenges remain:

Tumor Heterogeneity: GBM is characterized by significant cellular heterogeneity, meaning that tumor cells within the same mass can exhibit different sensitivities to AEF therapy. This necessitates further research into personalized treatment strategies.

Penetration Depth: The penetration depth of the electric field can be limited, particularly with transcranial AEF therapy. This limits its effectiveness in treating deeply seated tumors.

Long-term Effects: Long-term studies are necessary to assess the potential long-term effects of AEF therapy on brain tissue.

Future research directions include:

Developing more sophisticated electrode designs: This will improve the targeting and penetration of the electric field.

Investigating the combination of AEF therapy with other novel therapies: This may enhance its effectiveness and overcome resistance.

Developing biomarkers to predict patient response to AEF therapy: This will enable the identification of patients most likely to benefit from the treatment.

6. Conclusion

Alternating electric field therapy represents a promising adjuvant therapy for glioblastoma. Its non-invasive nature, coupled with its potential to enhance the efficacy of existing treatments, makes it an attractive option for patients with this devastating disease. Ongoing research is focused on overcoming current challenges and optimizing AEF therapy to improve patient outcomes. The continued development and refinement of alternating electric field therapy glioblastoma holds significant potential for transforming the

treatment landscape for this aggressive cancer.

FAQs

1. Is AEF therapy painful? AEF therapy is generally well-tolerated and not considered painful. Patients may experience mild discomfort or tingling sensations at the electrode sites.
1. What are the side effects of AEF therapy? Side effects are typically mild and can include scalp irritation, headaches, and fatigue. Serious side effects are rare.
1. How long does AEF therapy treatment last? The duration of AEF therapy varies depending on the treatment protocol and the individual patient's response.
1. Is AEF therapy approved by regulatory agencies? The approval status of AEF therapy varies depending on the specific device and the regulatory agency.
1. How does AEF therapy compare to other GBM treatments? AEF therapy is typically used as an adjuvant therapy alongside other treatments, enhancing their effectiveness.
1. Who is a candidate for AEF therapy? Patients with newly diagnosed GBM or recurrent GBM may be considered for AEF therapy, depending on various factors.
1. What is the cost of AEF therapy? The cost of AEF therapy can vary depending on the specific treatment protocol and the healthcare provider.

1. Where can I find clinical trials for AEF therapy for glioblastoma?
ClinicalTrials.gov is a good resource to find ongoing clinical trials.

1. What is the long-term survival rate with AEF therapy? Long-term survival rates vary depending on several factors, including the patient's overall health, the stage of the cancer, and the combination of treatments used.

Related Articles:

1. "The Role of Alternating Electric Fields in Cancer Therapy": This review article discusses the broader applications of AEF therapy in various cancers, providing a general understanding of the technology's potential.
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1. "Combination Therapy with Alternating Electric Fields and Temozolomide in Glioblastoma: A Preclinical Study": This study examines the synergistic effects of AEF therapy and chemotherapy in a preclinical model.
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1. "Comparative Effectiveness of Intracranial versus Transcranial AEF Therapy in Glioblastoma": This comparative study explores the efficacy and safety profiles of different AEF delivery methods.
1. "Challenges and Future Directions in the Development of Alternating Electric Field Therapy for Glioblastoma": This article focuses on the challenges that remain in AEF therapy and explores potential future research avenues.

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alternating electric field therapy glioblastoma: *Mosby's Oncology Nursing Advisor* **E-Book** Susan Maloney-Newton, Margie Hickey, Jeannine M. Brant, 2016-09-10 - NEW! Updated evidence-based content reflects the latest national and international quality standards regarding various cancer types, major drug and non-drug treatments, treatment protocols, and approaches to symptom management. - NEW! Nursing Practice Considerations section incorporates information on communication, cultural considerations, ethical considerations, safe and quality care, evidence-based practice, patient navigation, and patient education. - NEW! 17 new chapters cover topics including myelofibrosis, neuroendocrine cancers, tumor treating fields, oral adherence, clinical trials, epistaxis, hypersensitivity reactions, hypertension, hyperglycemia, nail changes, ocular and visual changes, rashes, survivorship, quality and safety, evidence-based practice, nurse navigation, and patient education. - NEW! Expanded content on patient education keeps readers on top of best practices in this critical area. - NEW! High-quality electronic patient teaching handouts are evidence-based and have been vetted by practicing nurses.

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alternating electric field therapy glioblastoma: *Re-Irradiation: New Frontiers* Carsten Nieder, Johannes Langendijk, 2016-10-25 This book, now in its second edition, provides a comprehensive overview of current re-irradiation strategies, with detailed discussion of re-irradiation methods, technical aspects, the role of combined therapy with anticancer drugs and hyperthermia, and normal tissue tolerance. In addition, disease specific chapters document recent clinical results and future research directions. All chapters from the first edition have been revised

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alternating electric field therapy glioblastoma: New Techniques for Management of 'Inoperable' Gliomas Michael E. Sughrue, Isaac Yang, 2019-08-03 New Techniques for Management of 'Inoperable' Gliomas radically challenges the assumption that certain gliomas cannot be removed with modern techniques, contesting stereotypical thinking and establishing new paradigms in the field. Gliomas are primary brain tumors which are often fatal. Recent data has demonstrated that despite the fact that surgery cannot cure gliomas, patient survival is substantially improved by removing as much of the tumor as possible. This fact has raised the imperative that neurologists try to improve techniques to bring surgical resection to as many patients as possible. This book brings new insights and technologies to the forefront, giving hope to patients. - Provides the first comprehensive book to discuss techniques for removing gliomas that are traditionally deemed 'inoperable' - Presents a great reference tool that challenges stereotypical thinking by offering techniques by innovative surgeons - Includes chapters that are organized by different glioma types and surgery/techniques

alternating electric field therapy glioblastoma: *Oncothermia: Principles and Practices* Andras Szasz, Nora Szasz, Oliver Szasz, 2010-11-23 Oncothermia is the next generation medical innovation that delivers selective, controlled and deep energy for cancer treatment. The basic principles for oncothermia stem from oncological hyperthermia, the oldest approach to treating cancer. Nevertheless, hyperthermia has been wrought with significant controversy, mostly stemming from shortcomings of controlled energy delivery. Oncothermia has been able to overcome these insufficiencies and prove to be a controlled, safe and efficacious treatment option. This book is the first attempt to elucidate the theory and practice of oncothermia, based on rigorous mathematical and biophysical analysis, not centered on the temperature increase. It is supported by numerous in-vitro and in-vivo findings and twenty years of clinical experience. This book will help scientists, researchers and medical practitioners in understanding the scientific and conceptual underpinnings of oncothermia and will add another valuable tool in the fight against cancer. Professor Andras Szasz is the inventor of oncothermia and the Head of St Istvan University's Biotechnics Department in Hungary. He has published over 300 papers and lectured at various universities around the world. Dr. Oliver Szasz is the managing director of Oncotherm, the global manufacturer and distributor of medical devices for cancer treatment used in Europe & Asia since the late 1980s. Dr. Nora Szasz is currently a management consultant in healthcare for McKinsey & Co.

alternating electric field therapy glioblastoma: Advances in Biology and Treatment of Glioblastoma Kumaravel Somasundaram, 2017-06-29 This volume covers the most important areas of glioblastoma - surgical resection, molecular pathology, targeted therapies, cancer stem cells, the role of DNA methylation, targeted sequencing for personalized therapy, animal models and advances in pediatric glioblastoma. Chapter authors are junior and senior investigators, who are well established in their particular areas and include neurosurgeons, neuropathologists, neurooncologists and basic scientists.

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alternating electric field therapy glioblastoma: *Handbook of Neuro-Oncology Neuroimaging* Herbert B. Newton, 2022-08-21 With treatment approaches and the field of neuro-oncology neuroimaging changing rapidly, this third edition of the *Handbook of Neuro-Oncology Neuroimaging* is very relevant to those in the field, providing a single-source, comprehensive, reference handbook of the most up-to-date clinical and technical information regarding the application of neuroimaging techniques to brain tumor and neuro-oncology patients. This new volume will have updates on all of the material from the second edition, and in addition features several new important chapters covering diverse topics such as imaging for the use of Laser Interstitial Thermal Therapy, advanced imaging techniques in radiation therapy, therapeutic treatment fields, response assessment in clinical trials, surgical planning of neoplastic disease of the spine, and more. Sections first overview neuro-oncological disorders before delving into the physics and basic science of neuroimaging and great focus on CT and MRI. The book then focuses on advances in the neuroimaging of brain tumors and neuroimaging of specific tumor types. There is also discussion of neuroimaging of other neuro-oncological syndromes. This book will serve as a resource of background information to neuroimaging researchers and basic scientists with an interest in brain tumors and neuro-oncology. - Summarizes translational research on brain imaging for brain tumors - Discusses limitations of neuroimaging for diagnosis and treatment - Presents advanced imaging technologies, including CT, MRI, and PET - Contains new coverage on Laser Interstitial Thermal Therapy, radiation therapy, clinical trials, and more

alternating electric field therapy glioblastoma: *The Pineal Gland and Cancer* C. Bartsch, H. Bartsch, D.E. Blask, D.P. Cardinali, W.J.M. Hrushesky, Dieter Mecke, 2012-12-06 The link between the pineal gland and cancer is a rapidly emerging research field due to promising experimental and clinical trials with melatonin. The pineal gland acts as a transducer of environmental light to regulate rhythmic processes, including reproductive function in seasonally breeding animals and the entrainment of circadian rhythms, such as the sleep-wake cycle, in man. This book elucidates the physiological significance of the pineal gland and surveys phenomena and mechanisms of pineal - tumor interaction at the neuroendocrine, neuroimmune, neural, and molecular levels. Yet unidentified low-molecular-weight pineal substances with tumor-inhibiting capacity, a possible involvement of melatonin in electromagnetic field effects on cancer, and the oncotherapeutic potential of melatonin are also addressed. The encouraging results should incite further research to elucidate the exact nature of the link between the pineal gland and cancer for the benefit of patients.

alternating electric field therapy glioblastoma: *Electromagnetic Fields and Energy* Hermann A. Haus, James R. Melcher, 1989

alternating electric field therapy glioblastoma: *Brain Tumors* Amit Agrawal, 2022-04-20 Brain tumors comprise a spectrum of histological patterns. Their presentation and management depend on their location, size, and grade of lesions. This book is a collection of high-quality research work from global experts on brain tumors, including meningiomas, and their treatment.

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Thermotherapy** Gerhard J. Müller, André Roggan, 1995

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alternating electric field therapy glioblastoma: Glioma Ibrahim Omerhodzic, Kenan Arnautovic, 2019-01-16 The past three decades have been marked with huge enthusiasm from scientists and professionals in an effort to find a cure for glioma disease. Methods to confirm the kinds and grades of glioma have taken a path from classical macro- to microscopic pathohystological confirmation of tumors, through morphological-histological, molecular, and genetic diagnosis. Surgically, progress was made possible with the development and use of technological aids, for example neuronavigation, cortical mapping, electrocorticography, neuromonitoring, functional and intraoperative MRI, magnetoencephalography, etc. Great hope was placed on the extension of tumor resection and popular supratotal resection. Significant progress has been made generally in glioma treatment with the use of modern radiotherapy and new chemotherapeutics. What do we want to see for the future? By way of stem cells, a specific medicine will be produced, individualized for the particular patient, and by using a microcapsule it will be implanted into the brain zone affected by the tumor by way of robot surgery and injection needle. This is not at all an unrealistic expectation in the next decade or two.

alternating electric field therapy glioblastoma: The Role of Modern Neuro-oncology in the Treatment of Primary CNS Tumors, and Brain and Spinal Metastases Marcos Vinicius Calfat Maldaun, Sujit Prabhu, Claudio Tatsui, Luis Souhami, 2020-07-10 This eBook is a collection of articles from a Frontiers Research Topic. Frontiers Research Topics are very popular trademarks of the Frontiers Journals Series: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area! Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers Editorial Office: frontiersin.org/about/contact.

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alternating electric field therapy glioblastoma: Bioelectrics Hidenori Akiyama, Richard Heller, 2016-09-19 This book focuses on bioelectrics, a new multidisciplinary field encompassing engineering and biology with applications to the medical, environmental, food, energy, and biotechnological fields. At present, 15 universities and institutes in Japan, the USA and the EU comprise the International Consortium of Bioelectrics, intended to advance this novel and important research field. This book will serve as an introductory resource for young scientists and also as a

textbook for use by both undergraduate and graduate students – the world's first such work solely devoted to bioelectrics.

alternating electric field therapy glioblastoma: Handbook of Brain Tumor

Chemotherapy, Molecular Therapeutics, and Immunotherapy Herbert B. Newton, 2018-03-28 Handbook of Brain Tumor Chemotherapy, Molecular Therapeutics, and Immunotherapy, Second Edition, provides a comprehensive overview of the molecular methodologies in the neuro-oncology field. There have been profound changes in the landscape of approaches to brain tumor therapy since the first edition—mainly in the areas of molecular biology and molecular therapeutics, as well as in the maturation of immunotherapy approaches (e.g., vaccines). This updated edition has a new, primary focus on multidisciplinary molecular methods, and is broadened to include the latest cutting-edge molecular biology, therapeutics, immunobiology and immunotherapy approaches. As the first comprehensive book to address the molecular research into these concepts, users will find it to be an invaluable resource on the topics discussed. - Provides the most up-to-date information regarding conventional forms of cytotoxic chemotherapy, as well as the basic science and clinical application of molecular therapeutics for the treatment of brain tumors - Broadly appeals to anyone interested in neuro-oncology and the treatment of brain tumors - Features updated chapters on molecular biology, molecular therapeutics, maturation of immunotherapy approaches, and a focus on multidisciplinary molecular methods - Includes a new section on the basic science of immunology, as well as thorough updates on the use of vaccine technology and immunotherapy for the treatment of brain tumors

alternating electric field therapy glioblastoma: Liver Cancers Tim Cross, Daniel H. Palmer, 2018-12-12 This book explores in detail the primary liver cancers of hepatocellular carcinoma and cholangiocarcinoma examining the pathogenesis of disease along with diagnosis and current management options together with exploration of future treatment strategies and areas of controversy. Furthermore, the book highlights management of the common secondary malignancies and touches on benign liver tumours and how to best manage these. Written in a clear and didactic style, this volume includes summaries of the key learning points and questions so that the reader can gauge their knowledge and understanding. This book is aimed to broaden the knowledge base of primary care physicians, general physicians along with specialists in hepatology, oncology and hepato-biliary surgery

alternating electric field therapy glioblastoma: Neurological Therapeutics John

Noseworthy, 2003-05-15 A comprehensive and authoritative textbook, Neurological Therapeutics: Principles and Practice provides a reference that is both authoritative and accessible for daily use. The textbook explores the issues underlying treatment decisions not only for the most readily treated disorders but also for those conditions with few existing, definitive therapeutic options. With 600 figures, 37 in full color, tables, and a companion volume that is portable and easy-to-use, the final product is an important reference.

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alternating electric field therapy glioblastoma: *Mathematical Foundations of Neuroscience* G. Bard Ermentrout, David H. Terman, 2010-07-01 This book applies methods from nonlinear dynamics to problems in neuroscience. It uses modern mathematical approaches to understand patterns of neuronal activity seen in experiments and models of neuronal behavior. The intended audience is researchers interested in applying mathematics to important problems in neuroscience, and neuroscientists who would like to understand how to create models, as well as the mathematical and computational methods for analyzing them. The authors take a very broad approach and use many different methods to solve and understand complex models of neurons and circuits. They explain and combine numerical, analytical, dynamical systems and perturbation methods to produce a modern approach to the types of model equations that arise in neuroscience. There are extensive chapters on the role of noise, multiple time scales and spatial interactions in generating complex activity patterns found in experiments. The early chapters require little more than basic calculus and some elementary differential equations and can form the core of a computational neuroscience course. Later chapters can be used as a basis for a graduate class and as a source for current research in mathematical neuroscience. The book contains a large number of illustrations, chapter summaries and hundreds of exercises which are motivated by issues that arise in biology, and involve both computation and analysis. Bard Ermentrout is Professor of Computational Biology and Professor of Mathematics at the University of Pittsburgh. David Terman is Professor of Mathematics at the Ohio State University.

alternating electric field therapy glioblastoma: *Angiogenesis Assays* Carolyn A. Staton, Claire Lewis, Roy Bicknell, 2007-01-11 Angiogenesis, the development of new blood vessels from the existing vasculature, is essential for physiological growth and over 18,000 research articles have been published describing the role of angiogenesis in over 70 different diseases, including cancer, diabetic retinopathy, rheumatoid arthritis and psoriasis. One of the most important technical challenges in such studies has been finding suitable methods for assessing the effects of regulators of the angiogenic response. While increasing numbers of angiogenesis assays are being described both in vitro and in vivo, it is often still necessary to use a combination of assays to identify the cellular and molecular events in angiogenesis and the full range of effects of a given test protein. Although the endothelial cell - its migration, proliferation, differentiation and structural rearrangement - is central to the angiogenic process, it is not the only cell type involved. The supporting cells, the extracellular matrix and the circulating blood with its cellular and humoral components also contribute. In this book, experts in the use of a diverse range of assays outline key components of these and give a critical appraisal of their strengths and weaknesses. Examples include assays for the proliferation, migration and differentiation of endothelial cells in vitro, vessel outgrowth from organ cultures, assessment of endothelial and mural cell interactions, and such in vivo assays as the chick chorioallantoic membrane, zebrafish, corneal, chamber and tumour angiogenesis models. These are followed by a critical analysis of the biological end-points currently being used in clinical trials to assess the clinical efficacy of anti-angiogenic drugs, which leads into a discussion of the direction future studies should take. This valuable book is of interest to research scientists currently working on angiogenesis in both the academic community and in the biotechnology and pharmaceutical industries. Relevant disciplines include cell and molecular biology, oncology, cardiovascular research, biotechnology, pharmacology, pathology and physiology.

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specific demands of brain tumor imaging. The potential and the limits of new imaging methodology are carefully addressed and compared to conventional MR imaging. In the main part of the book, the most important imaging criteria for the differential diagnosis of solid and necrotic brain tumors are delineated and illustrated in examples. A closing section is devoted to the use of MR methods for the monitoring of brain tumor therapy. The book is intended for radiologists, neurologists, neurosurgeons, oncologists and other scientists in the biomedical field with an interest in neuro-oncology.

alternating electric field therapy glioblastoma: Essentials of Clinical Radiation

Oncology Matthew C. Ward, MD, Rahul D. Tendulkar, MD, Gregory M. M. Videtic, MD, CM, FRCPC, 2017-12-28 Essentials of Clinical Radiation Oncology is a comprehensive, user-friendly clinical review that summarizes up-to-date cancer care in an easy-to-read format. Each chapter is structured for straightforward navigability and information retention beginning with a “quick-hit” summary that contains an overview of each disease, its natural history, and general treatment options. Following each quick-hit are high-yield summaries covering epidemiology, risk factors, anatomy, pathology, genetics, screening, clinical presentation, workup, prognostic factors, staging, treatment paradigms, and medical management for each malignancy. Each treatment paradigm section describes the current standard of care for radiation therapy including indications, dose constraints, and side effects. Chapters conclude with an evidence-based question and answer section which summarizes practice-changing data to answer key information associated with radiation treatment outcomes. Flow diagrams and tables consolidate information throughout the book that all radiation oncologists and related practitioners will find extremely useful when approaching treatment planning and clinical care. Essentials of Clinical Radiation Oncology has been designed to replicate a house manual created and used by residents in training and is a one-stop resource for practicing radiation oncologists, related practitioners, and radiation oncology residents entering the field. Key Features: Offers digestible information as a learning guide for general practice Examines essential clinical questions which are answered with evidence-based data from important clinical studies Places clinical trials and data into historical context and points out relevance in current practice Provides quick reference tables on treatment options and patient selection, workup, and prognostic factors by disease site

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Glioblastomas Ali Syed Arbab, 2021-03-10 New Targeting in The Reversal of Resistant Glioblastomas discusses alternative treatment strategies that not only target tumor cells but also target the tumor microenvironment, metabolic pathways and interaction of cytokines in tumor cells. The current treatment for primary and recurrent glioblastomas is failing because clinicians are not considering the effect of bone marrow derived cells to the development of resistance to clinically practiced therapies. This book helps readers rethink treatment strategies to successfully fight glioblastomas. It is a valuable resource for cancer researchers, clinicians, graduate students and other members of the biomedical field. Explains the effect of bone marrow derived cells on the development of resistance to clinically practiced therapies Provides information on the availability of alternate therapies for recurrent glioblastoma when standard practices have failed Discusses targeting tumor microenvironment using available FDA approved drugs as an alternative treatment strategy for glioblastoma

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Takao Tsuda, 2008-07-11 This authoritative review brings scientists up-to-date with the exciting recent developments in modern electric field applications and highlights their benefits compared with other methods. In Part 1 the book opens with a complete account of electrochromatography - a state-of-the-art technique that combines chromatography and electrophoresis. It reveals how you can achieve first-class separations in numerous analytical and biochemical applications. Part 2 focuses on the unique characteristics of electroprocesses in industry, and several examples, such as electroosmotic dewatering, new electro-rheological fluid technologies and demulsification processes in the car and oil industries, are given. The role of the electric field in chemical processes is

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2010-10-21 Neuro-oncologic (brain and spine) cancers account for 19,000 new cases and 13,000 deaths per year. The early and proper diagnosis of these virulent cancers is critical to patient outcomes and diagnosis and treatment strategies are continually evolving. The multidisciplinary team that manages these patients involves medical and radiation oncology, neurosurgery, neuroimaging, nurses and therapists. Principles and Practices of Neuro-Oncology establishes a new gold standard in care through a comprehensive, multidisciplinary text covering all aspects of neuro-oncology. Six major sections cover all topics related to epidemiology and etiology, molecular biology, clinical features and supportive care, imaging, neuroanatomy and neurosurgery, medical oncology and targeted therapies, and radiation oncology for adult and pediatric cancers. Expert contributors from multiple disciplines provide detailed and in-depth discussions of the entire field of neuro-oncology including histopathologic harmonization, neurosurgical techniques, quality of life and cognitive functions, and therapeutic changes in terms of combined modality treatments, advanced radiation techniques, the advent of new drugs, especially targeted agents, and the tantalizing early promise of personalized therapeutic approaches. With contributions from over 180 authors, numerous diagrams, illustrations and tables, and a 48 page color section, Principles and Practice of Neuro-Oncology reflects the breadth and depth of this multi-faceted specialty.

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at providing researchers and clinicians an update on different aspects of glioblastoma, i.e. progress in basic, preclinical and clinical research.

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