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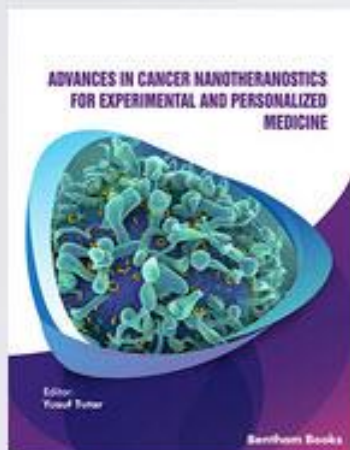
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ADVANCES IN CANCER NANOTHERANOSTICS FOR EXPERIMENTAL AND PERSONALIZED MEDICINE

Editor: Fouad Ayar Bentham Books

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FOREWORD

Oncologic drug development focused on single target-single drug strategy. However, cancer cells are genius! They can bypass inhibitor pathways and alternative routes. Further, human genome project results indicated that not as simple as central dogma; only few percent of the genome is sequenced. Rest of the genome function is involved in uncharacterized and cell biology. And epigenetics and metabolites add more complexity of molecular mechanisms in detail. This unknown mechanism makes cancer a great endeavor of eminent scientists and continuous research to elucidate cellular and tissue levels make drug design more effective every day.

To control the effect of several cellular factors, the new trend in content to employ drug cocktail that will synergistically act on these factors: drug targeting to eliminate off-targeting. For this purpose, nanocarriers deliver drugs to tumor microenvironment not only to treat the tumor but also to prevent metastasis.

Biomimicking is an old fashioned yet excellent method in disease treatment: target cancer cells and using this biomimick bullet macromolecule will serve as a fine treatment strategy. The biomimick bullet cargo consists of molecules from small to large molecules.

Targeting with nanotheranostic carriers provides specific tumor microenvironment. However, cancer cells so called "the other strategies" For example, transformation of a healthy cell to cancer cell may enhance signaling molecules and may introduce new set of metabolites. Further, coding gene's expression increases during this transformation. Altogether, level characterization of oncologic pathways may help our understanding. Currently, cancer nanotheranostics tries to find a short cut for experimental medicine in cancer treatment. This book covers recent advances in this

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PREFACE

Personalized medicine with novel therapeutic approaches provides direct targeting of macromolecules with contemporary drug delivery systems for treatment of severe diseases, including cancer. Nanotheranostic design offers increased bioavailability of the drugs through controlled release and distribution. Nanotheranostics also integrates diagnostic test with treatment of the disease. Recent advances in cancer studies revealed new genetic elements and factors that affect theranostic drug targeting approaches. Also, several tumors are challenging, and new treatment modalities are required. Molecular level mechanisms provide valuable information for therapy and innovative design for treatment. Several creative approaches have been proposed for theranostic therapy. For this reason, an updated approach over *in vivo* and translational properties of nanotheranostics with special emphasis on cancer will widen the scope of the readers/researchers with this book.

Chapter 1 despite significant advances in cancer therapy, many tumors are still challenging, and novel strategies are essential for treatment. Nanotheranostics use nanotechnology for diagnosis and therapy of cancer. Recent advancement in nanotechnology has provided novel types of nanomaterials composed of either organic- or polymer-based nanoparticles. Small alterations and modifications transform this carrier system with unique properties and optimize drug delivery and release. This chapter provides overview in cancer nanotheranostics field.

Chapter 2 overviews tumor microenvironment as prelude. This site regulates tumor progression and metastasis. Non-cellular components in this environment such as cytokines, chemokines, growth factors, inflammatory and matrix remodeling enzymes shape the progression of the disease by mediating the communication taking place between the tumor itself and its surrounding. This may prevent the benefits of therapeutical strategies. The chapter focuses on understanding the function and mechanism of these non-cellular components in the environment to elucidate obstacles in the treatment of cancer.

Chapter 3 covers immune system employment in fighting cancer cells to prevent tumor development. Immunotherapies are innovative cancer treatment. Nanomedical formulations modulate macrophages which can influence the tumor microenvironment, since macrophages target tumor environment. Macrophage may be used as trojan horse and its cargo may mediate gene and/or protein expression in the treatment regime. This section discusses improvements in cancer immunotherapies through this biological strategy.

Chapter 4 Gene and genome modification tools allow gene therapy through alteration of malignant genes and editing mutations for correction of errors. These innovative technologies deliver therapeutic nucleic acids to cells and tissues. Therefore, the success of gene therapy formulation is proportional to efficient delivery of the carrier and its nucleic acid cargo to a specific target and proper cellular uptake. The platforms have been developed for higher loading capacity, and low immunogenicity and toxicity. In chapter 4, the authors provide a review on different gene delivery vectors and platforms at the nanoscale.

Chapter 5 Oncology research applications may not yet fully suppress cancer-based mortalities and morbidities. Conventional therapeutic approaches have limitations as most research depends on coding genes. Human genome sequencing revealed that only 2-3 percent of the genome codes for genes and proteins however the rest is unknown. Further, heterogeneity among malignant tumors lead obstacles. Therefore, "precision medicine" in oncology and its extrapolation to "personalized treatment" for each cancer patient is essential. The chapter

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