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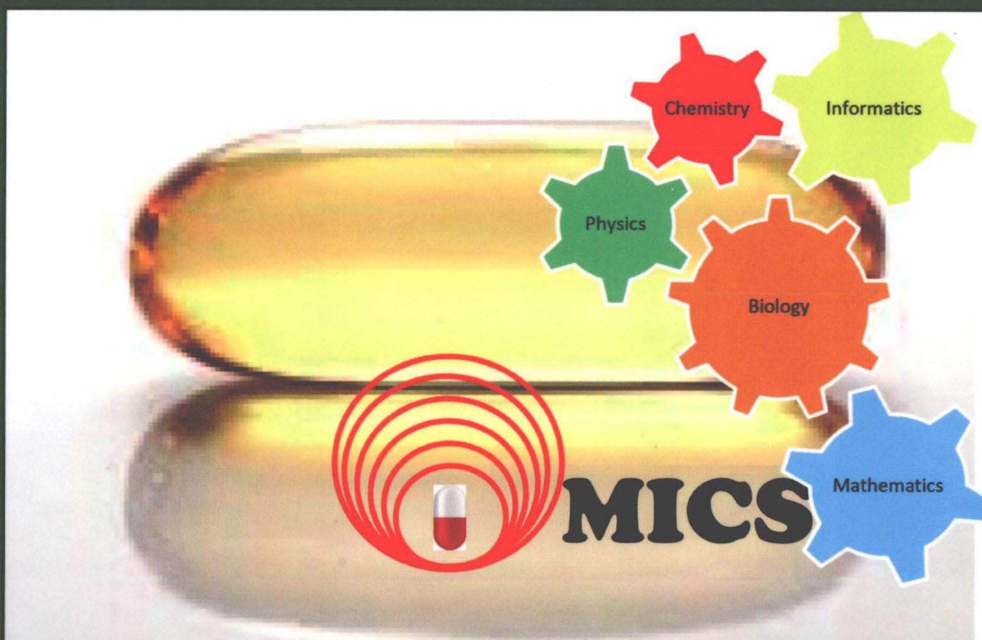
Postgenomic Approaches in Cancer and Nano Medicine



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Post-genomic Approaches in Cancer and Nano Medicine

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Post-genomic Approaches in Cancer and Nano Medicine

RIVER PUBLISHERS SERIES IN RESEARCH AND BUSINESS CHRONICLES: BIOTECHNOLOGY AND MEDICINE

Volume 4

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Series Note

The deciphering in 2003 of the nucleotide sequence of the human genome, which followed the determination of the chromosomal sequences of an array of model microorganisms including *Escherichia coli*, *Bacillus subtilis*, and *Saccharomyces cerevisiae*, is a landmark in biology that has paved the way for a revolution in research and development in biotechnology and pharmaceutical sciences. Moreover, several novel discovery tools have since emerged, including dramatically enhanced computers, sequencing instruments with dramatically higher throughout and decreased costs, softwares conferring the ability to generate and manage very large amounts of data, and systems biology tools which have enabled *in silico* experiments and the creation of virtual patients or virtual microbes to both accelerate and increase the scope of pharmaceutical and biotechnological research. Whereas more than 10 years have already elapsed since this major scientific milestone, the translation into novel products, perhaps best exemplified by the current focus of pharmaceutical companies on personalised medicine, has only reached mainstream at the beginning of the present decade.

The impact of post-genomic approaches in cancer and nano-medicine development is the focal point of the present monograph. Starting with a review of underlying bases of cancer and the biology of coding and non-coding RNAs, principles of discovery of novel drugs including advances in animal models for oncology are laid out here. Revisiting the potential of natural compounds for the treatment and prevention of carcinomas, the discussion subsequently explores one of the next innovation S-curves in cancer therapeutics using nanomaterials as a case study. The ultimate purpose of the journey is to accelerate the development of disease-modifying pharmaceuticals, and answer unmet medical needs to enable cancer patients worldwide achieve remission and, ideally, cure.

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Preface

Cancer is a complex disease involving genomic alterations across several molecular mechanisms. Systematic and comprehensive elucidation of the molecular landscape of a wide range of cancers complemented by genome-wide approaches to interrogating the function of cancer genes and the vulnerabilities of tumors will pave the way for understanding the basic molecular mechanisms of cancer and applying this knowledge to transform the practice of cancer medicine. Alternative splicing has critical roles in normal cell function and development and can promote growth and survival in cancer. Aberrant splicing can lead to loss-of-function in tumor suppressors or activation of oncogenes and cancer pathways. Cancer-specific changes in splicing profiles can occur through mutations that are affecting splice sites and splicing control elements, and also by alteration in the expression of proteins that control splicing decisions. Chapter 1 presents a comprehensive review on alternative splicing and how it contributes to tumorigenesis by producing splice isoforms that can stimulate cell proliferation and cell migration or induce resistance to apoptosis and anticancer agents. Chapter 2 discusses the use of non-coding RNAs as molecular tools to understand the molecular mechanism of cell proliferation control during carcinogenesis, differentiation and drug-induced cytotoxicity. Malignant cells exhibit metabolic changes, when compared to their normal counterparts. Chapter 3 delineates the identification and validation of novel targets of nuclear hormone receptor (PPAR-γ) in glycolytic pathway and their role in breast cancer pathophysiology. Animal experiments have contributed significantly to our understanding of mechanisms of disease and mouse has been the model of choice. Chapter 4 describes various mouse/rat models for cancer and infectious diseases. Chapter 5 describes the use of natural compounds for hepatocellular carcinoma.

The advent of nanotechnology promises revolutionizing many fields including oncology, by proposing advanced systems for cancer treatment.

Targeted drug delivery systems are among the most successful examples of nanotechnology. In the past few years, there has been significant momentum in the field of nanomedicine with the development of novel nanoparticles for the diagnosis and treatment of cancer. Their small size, large surface area-to-volume ratio, and surface characteristics enable them to have viable carrier for site specific delivery of vaccines, genes, drugs and other biomolecules in the body. They also have compatibility with different administration routes, which makes them highly attractive in many aspects of oncology and infectious diseases. Chapter 6 through Chapter 11 discuss the use of nanoparticles in cancer therapeutics. In putting together this book, we have tried to bring to table the contributions of various experts towards some key aspects in drug discovery with focus on cancer and naomedicine. As editors of this book, we are grateful to all the contributors who have made this book possible.

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On behalf of all the authors, we would like to thank all our mentors, colleagues and friends who instilled in us the culture of science. Without support from them, we could not have written this book. The unconditional love and support from our families is gratefully acknowledged.

Finally, we would like to take this opportunity to acknowledge the services of the team of River Publishers and everyone who collaborated in producing this book.

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List of Figures

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