MicroRNA and Cancer

Methods and Protocols

Second Edition

Edited by

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The discovery of microRNAs (miRNAs or miRs) heralded an exciting era in biology and started a new chapter in regulation of human genes. The miRNAs are a class of small endogenous noncoding RNAs (~22 nt) that fine-tune gene expression at the posttranscriptional level, mainly through binding 3'-UTR of mRNAs. They are involved in stem cell self-renewal, cellular development, differentiation, proliferation, and apoptosis.

Small miRNAs have big impacts in cancer development. Among the many miRNAs, a subset was identified as regulators of neoplastic transformation and tumor progression, invasion and metastasis as well as tumor-initiating cells (cancer stem cells). The widespread deregulation of miRNomes has been unveiled in diverse cancers compared to normal tissues. The oncomirs (oncogenic miRNAs), TSMiRs (tumor-suppressive miRNAs), and Metastasi-miRs (cancer metastasis associated miRNAs) comprise an important part of the cancer genome and, hence, they have pivotal diagnostic and prognostic significance. Moreover, cancer-associated miRNAs are proving worthwhile as effective cancer biomarkers for individualized medicine and potential therapeutic targets.

Six years after publication of the first edition of our book about “microRNA and cancer,” it has become a very popular reference in colleges, universities, and research institutes and I was encouraged to publish a second edition. This second edition provides the latest information at the forefront of miRNAs biology as it is being applied worldwide to cancer research. It is organized in the same style as the first edition with a review section and a protocol section. The review section is focused on current cancer research topics related to microRNA functions, including the roles of microRNAs in DNA damage, cancer-immune system interaction, cancer cell resistance, APOBEC gene expression, and gene expression noise. The protocol section is focused on experimental applications of microRNAs in various types of cancer and the scope of research covers detection of circulating microRNA, discovery of microRNA signatures using miRseq technology, evaluation of microRNA delivery systems, microRNA-based therapeutics, and finally, microRNA sequencing analysis.

MicroRNA research is a fast growing field and microRNAs are pivotal elements in cancer biology. An individual miRNA interferes with a broad range of mRNAs and, conversely, a single mRNA could be targeted by a variety of miRNAs. The complexity of miRNA::mRNA interactions is far-reaching in our understanding to date. This book provides the basic principles of experimental and computational methods for the study of microRNAs in cancer research and, therefore, provides a firm grounding for those who wish to develop further applications.

I am especially indebted to Drs. Shu Zheng, Suzanne D. Conzen, and Trever Bivona for giving me the opportunity to gain substantial experience in cancer research and I thank Dr. Fred G. Biddle for all kinds of support. Heartfelt gratitude goes to my family, who continue to patiently support me as I put forward my efforts related to the publication. Without their confidence and continuous support, many things would not have been possible. Also, I thank Professor John Walker for his encouragement and all staff from Springer for their hard work to produce the book. Finally, I am grateful to all the contributing authors for providing their high quality manuscripts.

San Francisco, CA, USA

Wei Wu M.D., Ph.D.
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