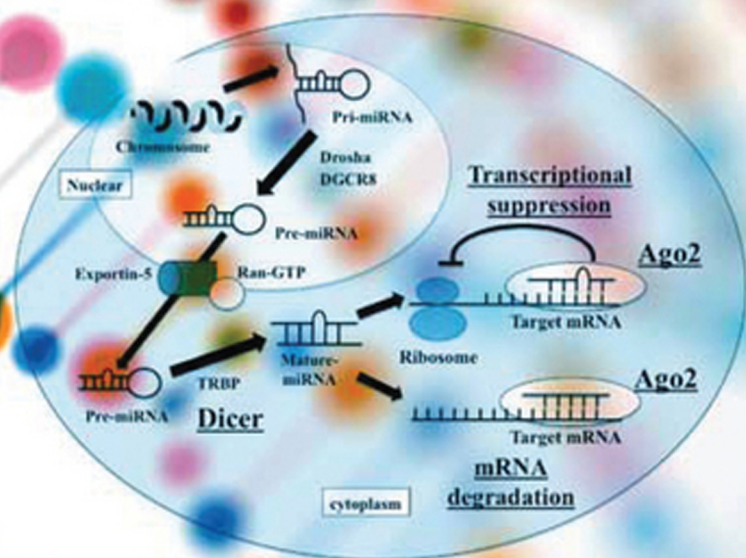


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Division of Toxicology, Center for Food Safety and Applied Nutrition,
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I lovingly dedicate this book to:

*My parents, Gopinath and Ichhamoni, for their gifts of life,
love and living examples*

*My wife, Jharana, for her life-long friendship, love and support,
as well as for her patience and understanding of the long hours spent at
home on planning, writing and editing this book.*

*My children, Megha, Sudhir and Subir,
for their love and care*

*Saura C. Sahu
Laurel, Maryland, USA*

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Preface

During the past decade it has become increasingly obvious that microRNAs regulate gene expressions and control many developmental and cellular processes in the eukaryotic organisms. Recent studies strongly suggest that they are likely to play important roles in a wide range of human diseases including cancer. As a result they have become an important component of the molecular mechanisms of the disease processes. Also, published reports strongly suggest that they are expected to play important roles in cellular response to xenobiotic stress affecting expression of microRNA as a mechanism of adaptation and, therefore, they have attracted great interest in toxicology. Thus microRNAs play an important role in toxicogenomics.

The importance of this field of research is evidenced by the increasing number of contributions published each year. It becomes increasingly clear that developments in this field are moving so rapidly that new means are needed to report the status of current ongoing research activities. The contributions presented in this monograph represent a collaborative effort by international experts working in this emerging field of science.

The main purpose of this book is to assemble up-to-date, state-of-the-art information on microRNAs presented by internationally recognized experts in a single edition. Therefore, I sincerely hope that this book will provide an authoritative source of current information on microRNA research and prove useful to the scientists interested in this scientific discipline throughout the world. It is my sincere hope that the information presented in this book will serve as a stimulus to all the investigators interested in this area of research. Also it should be of interest to a variety of other scientific disciplines including toxicology, medicine, and pharmacology, as well as food, drug, and other regulatory sciences.

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Editing this book has been a challenging journey. I express my sincere gratitude to all the individuals who have helped me, directly or indirectly, on this journey.

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Part I
microRNAs and Toxicology

1

Introduction

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The microRNA, found in eukaryotic cells, belongs to a family of small, single-stranded noncoding regulatory ribonucleic acid (RNA) molecules with an average of 22 nucleotides conserved by evolution (Christodoulou *et al.*, 2010). Discovered in 1993 (Lee *et al.*, 1993), they regulate gene expressions, and control many developmental and cellular processes in eukaryotic organisms. The physiological function of the majority of microRNAs is unknown. However, recent studies strongly suggest that they likely to play important roles in a wide range of human diseases, including cancer. As a result they have become an important component to study in the molecular mechanisms of disease processes. However, challenges remain in the understanding of their involvement in various disease processes. Therefore, microRNA research has become a hot new discipline in biology and medicine: microRNAs are promising important biomarkers of diseases.

The microRNAs have attracted great interest in toxicology. Published reports provide evidence that toxic exposures and cellular stress can affect microRNAs (Lema and Cunningham, 2010). Therefore, they are expected to play an important role in cellular responses to xenobiotic exposure. They bind to target messenger RNAs (mRNA) and suppress their translation into proteins. Exposure of cells to xenobiotics leads to altered microRNA expressions, as do other genes that play important roles in toxicology. Altered microRNA expression affects protein translation, which alters cellular physiology leading to adverse biological effects. Also cellular stress affects expression of microRNAs as a mechanism of adaptation (Lema and Cunningham, 2010). Thus microRNAs play an important role in toxicogenomics. Their potential as biomarkers of toxicity appears to be promising.

It is becoming increasingly clear from the rate of published literature that developments in microRNA research are moving rapidly. Therefore, new means are needed to report the current status of this new developing area of research. The purpose of this book, *microRNAs in Toxicology and Medicine*, is the timely dissemination of information on current interests in this emerging field of science. As the Editor, it gives me great pride to introduce this unique book which encompasses many aspects of microRNA research never

published together before. It is only recently that this exciting area of research has attracted the attention of toxicologists. This book deals with information on microRNAs at a level designated to take the reader to the borderline of research in this newly developing scientific discipline. The microRNA research work, actively pursued throughout the world, will lead to major discoveries of fundamental importance and of great clinical significance. This book brings together the ideas and work of investigators of international reputation who have pioneered this exciting area of research in toxicology and medicine. The book provides up-to-date information as well as new challenges in this exciting research area, and reflects the remarkable blossoming of this research in recent years. New ideas and new approaches are brought to bear on exploration of the role played by microRNAs in toxicology and medicine. Therefore, exciting times are ahead for future research. The up-to-date techniques, ideas, applications, and bibliographies are presented in this book in sufficient detail to enable newcomers to this scientific discipline to apply them in their studies and pursue them to any depth. I sincerely hope that the book will provide authoritative information as well as new ideas and challenges on microRNA research for stimulating the creativity of graduate students and investigators who are actively engaged in this rapidly developing field. The extensive collection of current information presented here will make it a valuable reference source for all scientists working in the microRNA area.

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