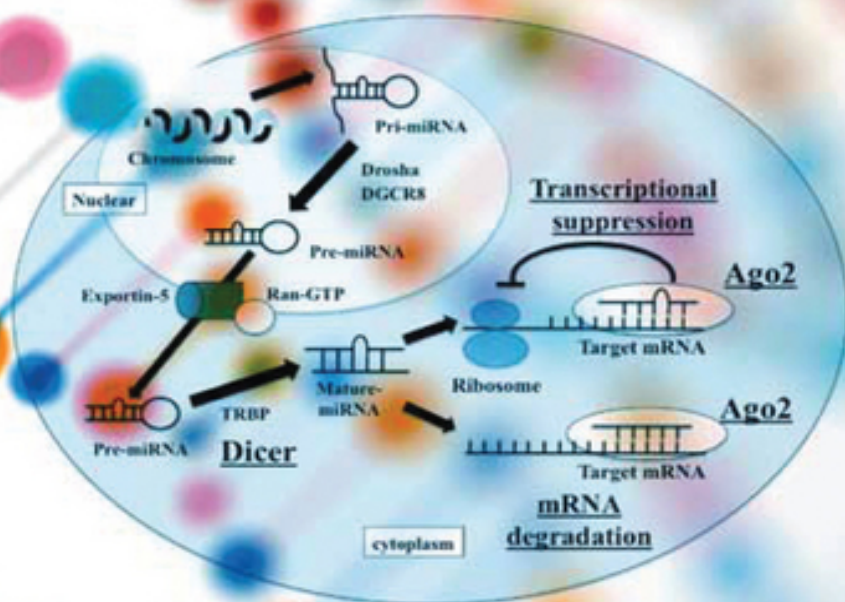


Editor SAURA C. SAHU

microRNAs in Toxicology and Medicine



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microRNAs in Toxicology and Medicine

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WILEY

This edition first published 2014

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Registered office

John Wiley & Sons Ltd, The Atrium, Southern Gate,
Chichester, West Sussex, PO19 8SQ, United Kingdom

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Library of Congress Cataloging-in-Publication Data

microRNAs in Toxicology and Medicine / editor, Saura C. Sahu.

pages cm

Includes bibliographical references and index.

ISBN 978-1-118-40161-3 (cloth)

1. Small interfering RNA. 2. Small interfering RNA -
Therapeutic use. 3. Genetic regulation. I. Sahu, Saura C.,
editor of compilation.

QP623.5.S63M536 2014

572.8'8 - dc23

2013020036

A catalogue record for this book is available from the British
Library.

ISBN: 9781118401613

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

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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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Acknowledgments

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.

I am indebted to the internationally recognized experts, who shared my enthusiasm for this field of science and contributed generously to this book. They were selected from academia, industry, and government for their expertise in their own areas of research. Their work speaks for itself and I am grateful to them for their strong commitment, cooperation and excellent contributions in their own areas of expertise.

I thank the staff of the publisher, John Wiley & Sons, Ltd, especially Rebecca Ralf and Sarah Tilley for their excellent help, cooperation, support, and editorial assistance in the timely publication of this book.

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Part I

microRNAs and Toxicology

Chapter 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