

C O N T E M P O R A R Y C A N C E R R E S E A R C H

# DNA DAMAGE AND REPAIR

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*Volume III:  
Advances  
from Phage  
to Humans*

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EDITED BY

JAC A. NICKOLOFF

MERL F. HOEKSTRA



HUMANA PRESS

# **DNA Damage and Repair**

# Contemporary Cancer Research

*DNA Damage and Repair, Volume 3: Advances from Phage to Humans*, edited by **Jac A. Nickoloff and Merl F. Hoekstra**, 2001

*Prostate Cancer: Biology, Genetics, and the New Therapeutics*, edited by **Leland W. K. Chung, William B. Isaacs, and Jonathan W. Simons**, 2001

*Chemokines and Cancer*, edited by **Barrett J. Rollins**, 1999

*Breast Cancer: Molecular Genetics, Pathogens, and Therapeutics*, edited by **Anne M. Bowcock**, 1999

*DNA Damage and Repair, Volume 1: DNA Repair in Prokaryotes and Lower Eukaryotes*, edited by **Jac A. Nickoloff and Merl F. Hoekstra**, 1998

*DNA Damage and Repair, Volume 2: DNA Repair in Higher Eukaryotes*, edited by **Jac A. Nickoloff and Merl F. Hoekstra**, 1998

# DNA Damage and Repair

*Volume 3*

*Advances from Phage to Humans*

Edited by

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*University of New Mexico, Albuquerque, NM*

and

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999 Riverview Drive, Suite 208  
Totowa, New Jersey 07512

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This publication is printed on acid-free paper.   
ANSI Z39.48-1984 (American Standards Institute) Permanence of Paper for Printed Library Materials.

Production Editors: Laura Huber and John Morgan.  
Cover design by Patricia F. Cleary.

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Printed in the United States of America. 10 9 8 7 6 5 4 3 2 1

Library of Congress Cataloging in Publication Data

DNA damage and repair/edited by Jac A. Nickoloff and Merl F. Hoekstra  
p. cm.—(Contemporary cancer research)

Includes index.

Contents: v. 1. DNA repair in prokaryotes and lower eukaryotes—v. 2. DNA repair in higher eukaryotes—v. 3. DNA repair, advances from phage to humans.

ISFN 0-89603-356-2 (v. 1: alk. paper)—ISBN 089603-500-X (v. 2: alk. paper)—0-89603-803-3 (v. 3: alk. paper)

1. DNA repair. I. Hoekstra, Merl F. II. Series

[DNLM: 1. DNA Repair. 2. DNA Damage. 3. DNA—physiology. 4. Prokaryotic Cells. 5. Eukaryotic Cells. QH 467 D629 2001]

QH467.D15 2001

572.8'6—d21

DNLM/DLC

for Library of Congress

97-28562  
CIP

## Preface

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Even before we completed Volumes I and II of *DNA Damage and Repair* in 1998, three facts made it very clear that a third volume would be necessary. First, despite our best attempts at providing comprehensive coverage of this rather large and rapidly expanding field, we were unable to identify authors for several important topics. Volume III: *Advances from Phage to Humans* thus fills some of the gaps in the previous volumes, including DNA repair in bacteriophage and *Drosophila*, and the role of DNA repair in the generation of immune diversity. Second, the DNA repair field continues to grow explosively, and several topics needed updating soon after the first volumes were published. Such topics include the role of homologous recombination in mammalian cells, and the new biochemistry and cell biology of DNA double-strand break repair, which has provided key information about protein function in this important biological process. Third, as might be expected from such an active field, there are several new areas of research that were not even imagined prior to 1998, including the finding that proteins involved in nonhomologous end-joining were also involved in gene silencing and telomere function, and the discovery that the breast cancer susceptibility genes, *BRCA1* and *BRCA2*, have important roles in several aspects of DNA repair.

The DNA repair field grew from basic studies in genetics and cell biology. These approaches are increasingly complemented by biochemical approaches that provide detailed descriptions of complex processes at the molecular level and identify functional interactions among the various proteins involved in each repair pathway. Although early work provided provocative hints that DNA repair processes were conserved from bacteria to higher eukaryotes, a full appreciation of this conservation was not possible until many more genes were isolated and sequenced, and their gene products characterized at the biochemical level. This area of research has in turn led to the understanding that functions carried out by a single protein in prokaryotes are often performed by several related proteins in eukaryotes, and that these protein family members are often found in multi-subunit complexes. Another new development in the field is that seemingly distinct DNA repair processes, such as mismatch repair and nucleotide excision repair, show functional overlap, particularly at the level of lesion recognition. Such overlap suggests that DNA repair processes form a complex network. It is likely that this network enables cells to respond appropriately to different quantities and qualities of DNA damage. As we stand on the threshold of the “New Age of Functional Genomics and Proteomics,” it is clear that the next level of understanding will be a molecular description of DNA repair networks in various cell types, and how these networks produce the various cellular responses to different types of DNA damage. Of course, a discussion of the future of DNA repair research begs the question:

Will there be a need for Volume IV? The answer of course is yes, but just when this task will be undertaken (and by whom) is not yet clear.

We thank all of the contributors for their considerable time and effort to produce the high-quality texts, and for their assistance in the development of the chapter titles and in reviewing draft manuscripts. We also thank our many colleagues, both within and outside our laboratories, for their continued support. And we again thank our families for their patience and understanding: Denise, Jake, Ben, Courtney, Debra, Brad, Lauren, Brielle, and Alexa.

*Jac A. Nickoloff*  
*Merl F. Hoekstra*

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