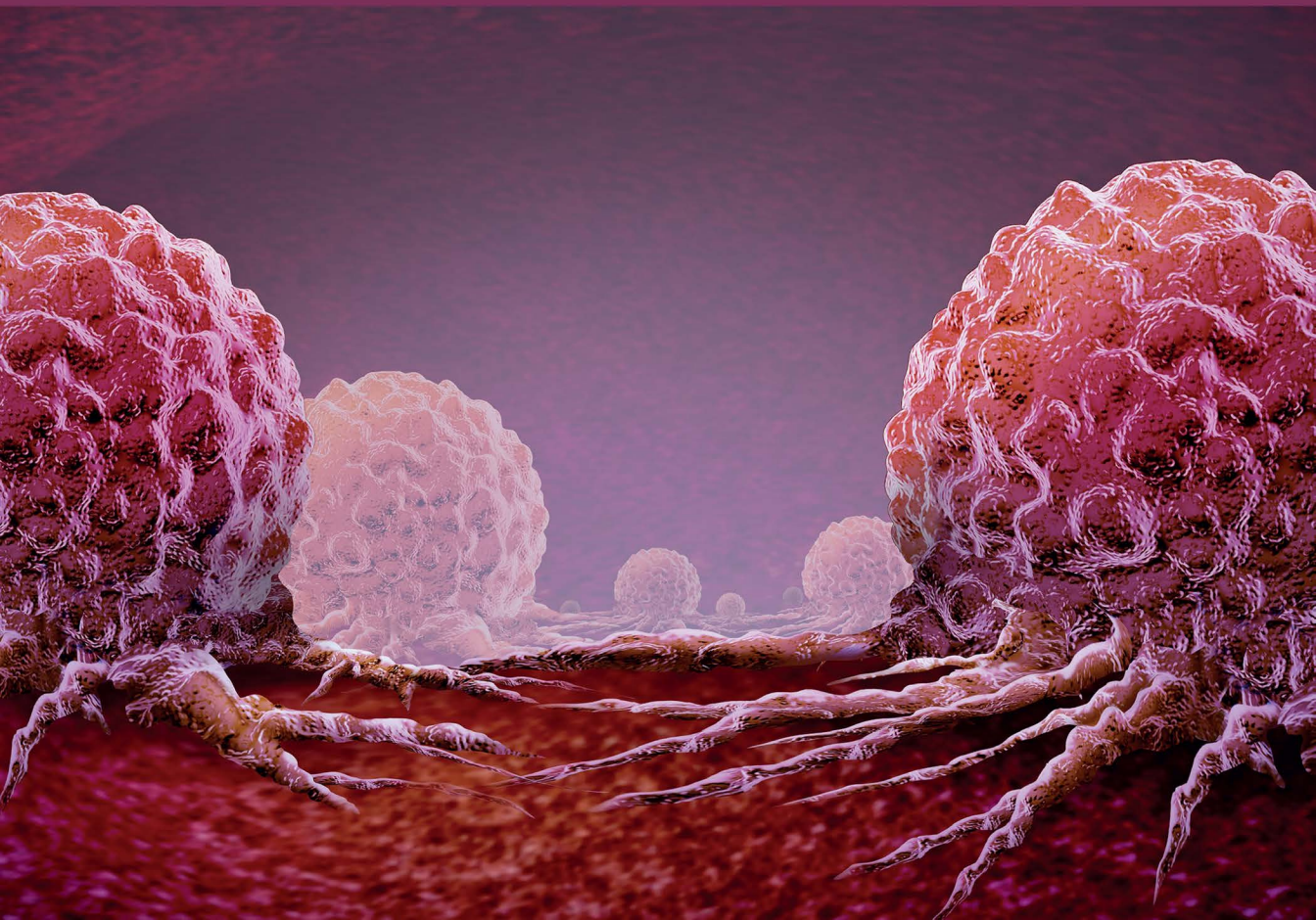


# Extrachromosomal DNA in Cancer

Mechanisms, Biomarkers,  
and Therapeutic Implications

**Edited by Sumel Ashique, Ayush Madan,  
Biplab Debnath, and Gokhan Zengin**



# Extrachromosomal DNA in Cancer

This book provides a comprehensive review of the emerging role of extrachromosomal DNA (ecDNA) in cancer, highlighting its significance in tumor progression, oncogene amplification, drug resistance, and clinical applications. *Extrachromosomal DNA in Cancer: Mechanisms, Biomarkers, and Therapeutic Implications* explores the structural and functional characteristics of ecDNA, emphasizing its role in shaping the genetic and epigenetic landscapes of cancer cells. The book discusses the impact of ecDNA on tumor heterogeneity, metastasis, and immune evasion, providing insights into how ecDNA contributes to cancer evolution and therapeutic resistance. The text also examines cutting-edge imaging techniques, computational approaches, and non-invasive diagnostic applications of ecDNA, highlighting its potential as a biomarker in precision oncology. Additionally, it presents the novel therapeutic strategies targeting ecDNA, addressing challenges and opportunities in integrating these insights into cancer treatment.

## FEATURES

- Explores the structural formation and oncogenic role of ecDNA in tumor development and progression
- Discusses the influence of ecDNA on gene expression, epigenetics, and immune modulation in cancer
- Examines the role of ecDNA in drug resistance, metastasis, and disease recurrence
- Highlights advanced imaging, computational tools, and non-invasive diagnostic applications of ecDNA
- Reviews emerging therapeutic strategies targeting ecDNA for improved cancer treatment and personalized medicine

This book is intended for researchers and students of cancer biology, molecular biology, and biotechnology.



**Taylor & Francis**

Taylor & Francis Group

<http://taylorandfrancis.com>

# Extrachromosomal DNA in Cancer

Mechanisms, Biomarkers, and  
Therapeutic Implications

Edited by  
Sumel Ashique, Ayush Madan,  
Biplab Debnath, and Gokhan Zengin



**CRC Press**

Taylor & Francis Group

Boca Raton London New York

---

CRC Press is an imprint of the  
Taylor & Francis Group, an **informa** business

Designed cover image: Shutterstock.

First edition published 2026

by CRC Press

2385 NW Executive Center Drive, Suite 320, Boca Raton FL 33431

and by CRC Press

4 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

*CRC Press is an imprint of Taylor & Francis Group, LLC*

© 2026 Taylor & Francis Group, LLC

© 2026 selection and editorial matter, Sumel Ashique, Ayush Madan, Biplab Debnath, and Gokhan Zengin; individual chapters, the contributors

Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, access [www.copyright.com](http://www.copyright.com) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. For works that are not available on CCC please contact [mpkbookspermissions@tandf.co.uk](mailto:mpkbookspermissions@tandf.co.uk)

*Trademark notice:* Product or corporate names may be trademarks or registered trademarks and are used only for identification and explanation without intent to infringe.

ISBN: 978-1-041-10483-4 (hbk)

ISBN: 978-1-041-10484-1 (pbk)

ISBN: 978-1-003-65529-9 (ebk)

DOI: 10.1201/9781003655299

Typeset in Times

by Apex CoVantage, LLC

---

# Contents

Preface.....	vii
The Editors.....	ix
<b>Chapter 1</b> Overview of ecDNA: Discovery and Emerging Significance in Cancer .....	1
<i>Debajit Dewan, Lopamudra Chakraborty, Kabirul Islam Mollah, and Soma Jana</i>	
<b>Chapter 2</b> Formation and Structure of ecDNA in Cancer Cells .....	13
<i>Sanjesh Kumar, Mansi Singh, M. V. N. L. Chaitanya, Joy Das, Tapan Kumar Shaw, Mohini Mondal, and Sumel Ashique</i>	
<b>Chapter 3</b> ecDNA in Oncogene Amplification and Tumor Progression.....	28
<i>Soukat Chandra, Souvik Biswas, Nikunj Solanki, Sonal Solanki, and S. Mohana Lakshmi</i>	
<b>Chapter 4</b> Gene Expression and Epigenetic Landscapes of ecDNA in Cancer .....	38
<i>Vijay Singh, Sapna Saini, Sumit Jangra, and Mohammad Muztaba</i>	
<b>Chapter 5</b> ecDNA: Role in Cancer Drug Resistance .....	52
<i>Joy Das, Utpal Bhui, Komal Kriti, Yogesh Tiwari, Sachin Raikwar, and Farzad Taghizadeh-Hesary</i>	
<b>Chapter 6</b> Imaging, Visualization, and Characterization of ecDNA in Cancer Cells .....	63
<i>Navjot Kaur Sandhu, Issac V. Cherian, Abhishek VijuKumar, Sheikh Mohammad Faisal, and Chowdhury Mobaswar Hossain</i>	
<b>Chapter 7</b> Extrachromosomal DNA in Non-Invasive Cancer Diagnostics.....	76
<i>Prabir Manna, Suravi Saha, Pritha Dey, Bijoy Paria, and Payal Chakraborty</i>	
<b>Chapter 8</b> Extrachromosomal DNA (ecDNA) as Diagnostic Biomarkers for Cancers .....	84
<i>Riffat Maqsood, Muhammad Usman, Muhammad Nasir Bhaya, Ayush Madan, and Benedict Terkula Iber</i>	
<b>Chapter 9</b> ecDNA Knowledge for Personalized Medicines.....	97
<i>Navpreet Kaur, Omji Porwal, Narendra Kumar Pandey, Shubham Kumar, Sumel Ashique, and Bimlesh Kumar</i>	

<b>Chapter 10</b>	ecDNA Formation: Tumor Immune Escape.....	107
	<i>Mohammad Habeeb, Hariharan Thirumalai Vengateswaran, Darshan S., and Ciniraj Raveendran</i>	
<b>Chapter 11</b>	The Role of ecDNA in Tumor Heterogeneity and Evolution .....	121
	<i>Syed Mustafizur Rahaman, Misbaul Hoque, Saba Wahid A.M. Khan, Radheshyam Pal, Shreyasi Katari, Mirazuddin Mollick, and Md. Yousuf Ansari</i>	
<b>Chapter 12</b>	Role of ecDNA in Cancer Metastasis and Disease Recurrence.....	134
	<i>Anas Islam, Asad Ahmad, Badruddeen, Mohammad Irfan Khan, and Yusuf Asad</i>	
<b>Chapter 13</b>	Computational Approaches to Study ecDNA in Cancer Genomics.....	142
	<i>Monika Kaushik, Priya Chaudhary, Mohini Mondal, Rohini Armo, Nikunj Solanki, and Sonal Solanki</i>	
<b>Chapter 14</b>	ecDNA and Immune Modulation: Progress and Challenges of Cancer Immunotherapy .....	155
	<i>Debasmita Paul, Arijit Das, Abhijit Ghosh, and Biplab Debnath</i>	
<b>Chapter 15</b>	Extrachromosomal DNA (ecDNA) and Clinical Implications in Cancer.....	166
	<i>Yumna Khan, Mudasir Maqbool, Somya Sharma, Amita Joshi Rana, Ayesha Sultana, and Md. Sadique Hussain</i>	
<b>Chapter 16</b>	Targeting ecDNA: Novel Therapeutic Approach.....	181
	<i>Oyindamola John Samson, John Olusola Olayiwola, Ayush Madan, Titilola Fausat Salisu, and Ismail Babatunde Onajobi</i>	
<b>Index</b> .....		193

---

# Preface

The emergence of extrachromosomal DNA (ecDNA) as a pivotal player in cancer biology has transformed our understanding of tumorigenesis, genomic instability, and therapeutic resistance. Unlike chromosomal DNA, ecDNA exists outside the standard chromosomal framework, often carrying amplified oncogenes that drive aggressive cancer phenotypes. *Extrachromosomal DNA in Cancer: Mechanisms, Biomarkers, and Therapeutic Implications* provides a comprehensive overview of the origin, structure, and function of ecDNA in various cancer types. It explores the molecular mechanisms underlying ecDNA formation and its dynamic role in tumor evolution, heterogeneity, and adaptability.

Recent advances in next-generation sequencing and single-cell technologies have made it possible to detect ecDNA with greater precision, positioning it as a promising biomarker for cancer diagnosis, prognosis, and treatment monitoring. Moreover, targeting ecDNA-associated pathways offers novel therapeutic strategies, particularly in combating drug resistance and recurrence.

This book is intended for researchers, oncologists, molecular biologists, and graduate students seeking to understand the emerging significance of ecDNA in cancer. Through detailed chapters and updated evidence, we aim to bridge basic research with clinical translation, fostering innovation in cancer diagnostics and precision medicine. We hope this text inspires further exploration into the untapped potential of ecDNA as a transformative element in cancer therapy.



**Taylor & Francis**

Taylor & Francis Group

<http://taylorandfrancis.com>