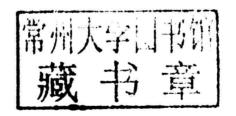
Varsha Gandhi · Kapil Mehta Rajesh Grover · Sen Pathak Bharat B. Aggarwal *Editors*

Multi-Targeted Approach to Treatment of Cancer

Varsha Gandhi • Kapil Mehta • Rajesh Grover • Sen Pathak • Bharat B. Aggarwal Editors

Multi-Targeted Approach to Treatment of Cancer



Editors Varsha Gandhi Department of Experimental Therapeutics Department of Experimental Therapeutics University of Texas M.D. Anderson Cancer Center Houston, Texas, USA

Kapil Mehta University of Texas M.D. Anderson Cancer Center Houston, Texas, USA

Rajesh Grover Delhi State Cancer Institute (East) Delhi India

Sen Pathak Department of Experimental Therapeutics University of Texas M.D. Anderson Cancer Center Houston, Texas, USA

Bharat B. Aggarwal Department of Bioimmunotherapy Section of Cytokine Research University of Texas M.D. Anderson Cancer Center Houston, Texas, USA

ISBN 978-3-319-12252-6 ISBN 978-3-319-12253-3 (eBook) DOI 10.1007/978-3-319-12253-3 Springer Cham Heidelberg New York Dordrecht London

Library of Congress Control Number: 2015930738

© Springer International Publishing Switzerland 2015

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Multi-Targeted Approach to Treatment of Cancer

Contributors

Rajesh Agarwal Department of Pharmaceutical Sciences, Skaggs School of Pharmacy and Pharmaceutical Sciences, San Diego, CA, USA

University of Colorado Cancer Center, University of Colorado Anschutz Medical Campus, Aurora, CO, USA

Bharat B. Aggarwal Department of Bioimmunotherapy, Section of Cytokine Research, University of Texas, M.D. Anderson Cancer Center, Houston, Texas USA

Navneet Agnihotri Department of Biochemistry, Punjab University, Chandigarh, India

Sahar Ahmed Applied Surfactant Laboratory, Department of Petrochemicals, Egyptian Petroleum Research Institute, Cairo, Egypt

M. A. Ansari Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

Abeer Ashmawy Tumor Biology Department, National Cancer Institute, Cairo, Egypt

Anish Babu Department of Pathology, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

Stephenson Cancer Center, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

Abdelfattah M. Badawi Applied Surfactant Laboratory, Department of Petrochemicals, Egyptian Petroleum Research Institute, Nasr City Cairo, Egypt

Kumudha Balakrishnan Departments of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Kanthesh Basalingappa Stephenson Cancer Center, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

x Contributors

Department of Radiation Oncology, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

Alok C. Bharti Division of Molecular Oncology, Institute of Cytology and Preventive Oncology, Noida, Uttar Pradesh, India

Massimo Bonucci, M.D. Chief of Surgical Pathology Department-Oncology outpatient, SAN FELICIANO Hospital-Rome, Rome, Italy

Ramesh Butti National Centre for Cell Science, NCCS Complex, Pune, India

Megha Chagtoo Department of Molecular Medicine and Biotechnology, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, India

Bandana Chakravarti Department of Molecular Medicine and Biotechnology, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, India

Mi Kyung Chung Cancer Prevention Research Center, CHA University School of Medicine, Seoul, Korea

Mona Dardir Applied Surfactant Laboratory, Department of Petrochemicals, Egyptian Petroleum Research Institute, Cairo, Egypt

Bhudev C. **Das** Department of Molecular Oncology, B.R. Ambedkar Centre for Biomedical Research (ACBR), University of Delhi, New Delhi, India

Lokesh Deb Cytokine Research Laboratory, Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Maria Rosaria Galdiero Humanitas Clinical and Research Center, Rozzano, MI, Italy

Division of Clinical Immunology and Allergy, University of Naples Federico II, Naples, Italy

Varsha Gandhi Department of Experimental Therapeutics, University of Texas, M.D. Anderson Cancer Center, Houston, Texas, USA

Pompom Ghos National Centre for Cell Science, NCCS Complex, Pune, India

Madan M. Godbole Department of Molecular Medicine and Biotechnology, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, India

P. Gupta Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

Ki Baik Hahm, M.D., Ph.D. CHA University Cancer Prevention Research Center, Seoul, Korea

Digestive Disease Center, Bundang Medical Center, CHA University, Seongnam, Korea

Contributors xi

Youngmin Han Cancer Prevention Research Center, CHA University School of Medicine, Seoul, Korea

Roopa Hariprasad, M.B.B.S., DGO. Division of Clinical Oncology, Institute of Cytology and Preventive Oncology, Noida, India

Jiamin Huang Cytokine Research Laboratory, Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Ashgan Ibrahem Applied Surfactant Laboratory, Department of Petrochemicals, Egyptian Petroleum Research Institute, Cairo, Egypt

Dina A. Ismail Applied Surfactant Laboratory, Department of Petrochemicals, Egyptian Petroleum Research Institute, Cairo, Egypt

Gaganjot Singh Kalsey, Ph.D. Department of Zoology, SGTB Khalsa College, University of Delhi, Delhi, India

Napapan Kangwan Cancer Prevention Research Center, CHA University School of Medicine, Seoul, Korea

Vinay K Kapoor Professor of Surgical Gastroenterology, Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow, UP, India

Rajarshi Kar Department of Biochemistry, AIIMS, New Delhi, India

Paramjeet Kaur Department of Botanical and Environmental Sciences, Guru Nanak Dev University Amritsar, Punjab, India

Eun Hee Kim Cancer Prevention Research Center, CHA University School of Medicine, Seoul, Korea

Santosh Kumar Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Sandeep Kumar Department of Biochemistry, Punjab University, Chandigarh, India

Totakvra V. S. Kumar National Centre for Cell Science, NCCS Complex, Pune, India

Gopal C. Kundu National Centre for Cell Science, NCCS Complex, Pune, India

Sung Hun Kwon Cancer Prevention Research Center, CHA University School of Medicine, Seoul, Korea

Chang Il Kwon Digestive Disease Center, Bundang Medical Center, CHA University, Seongnam, Korea

Nahla A. Mansour Applied Surfactant Laboratory, Department of Petrochemicals, Egyptian Petroleum Research Institute, Cairo, Egypt

xii Contributors

Alberto Mantovani Humanitas Clinical and Research Center, Rozzano (Milan), Italy

Division of Clinical Immunology and Allergy, University of Naples Federico II, Naples, Italy

Department of Biotechnology and Translational Medicine, University of Milan, Rozzano (Milan), Italy

Qaisar Manzoor Cytokine Research Laboratory, Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Ravi Mehotra, M.D., Ph.D., FRCPath, D.Phil. Department of Health Research (Govt. of India), Institute of Cytology and Preventive Oncology (ICMR), Noida, India

Meghna Mehta Stephenson Cancer Center, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

Department of Radiation Oncology, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

Kapil Mehta Department of Experimental Therapeutics, University of Texas, M. D. Anderson Cancer Center, Houston, Texas, USA

Ammona Mohamad Applied Surfactant Laboratory, Department of Petrochemicals, Egyptian Petroleum Research Institute, Cairo, Egypt

Dalia E. Mohamed Applied Surfactant Laboratory, Department of Petrochemicals, Egyptian Petroleum Research Institute, Cairo, Egypt

Anupama Munshi Stephenson Cancer Center, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

Department of Radiation Oncology, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

Ranganayaki Muralidharan Department of Pathology, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

Stephenson Cancer Center, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

Deeksha Pal Department of Biochemistry, Postgraduate Institute of Medical Education and Research, Chandigarh, India

Jong-Min Park Cancer Prevention Research Center, CHA University School of Medicine, Seoul, Korea

Viralkumar Patel Departments of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Contributors xiii

Seema Patel Department of Biochemistry, AIIMS, New Delhi, India

Sen Pathak Department of Experimental Therapeutics, University of Texas, M.D. Anderson Cancer Center, Houston, Texas, USA

Rajendra Prasad Department of Biochemistry, PGIMER, Chandigarh, India

Sahdeo Prasad Cytokine Research Laboratory, Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

N. Naga Venkata Radharani National Centre for Cell Science, NCCS Complex, Pune, India

Nimma Ramakrishna National Centre for Cell Science, NCCS Complex, Pune, India

Sasha Raman Cytokine Research Laboratory, Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Rajagopal Ramesh Department of Pathology, The Stanton Young Biomedical Research Center, Oklahoma City, OK, USA

Satyavati Rana Department of Super Specialty Gastroenterology, Post Graduate Institute of Medical Education and Research, Chandigarh, India

Isha Rani Department of Biochemistry, Punjab University, Chandigarh, India

Jagnyeswar Ratha Cytokine Research Laboratory, Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Appu Rathinavelu, Ph.D. Rumbaugh Goodwin Institute for Cancer Research, College of Pharmacy, Health Professions Division, Nova Southeastern University, Fort Lauderdale, FL, USA

Arfaa Sajid Cytokine Research Laboratory, Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Ujjawal Sharma Department of Biochemistry, Postgraduate Institute of Medical Education and Research, Chandigarh, India

V. K. Shukla, MS, M.Ch. Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

Sukh Mahendra Singh School of Biotechnology, Banaras Hindu University, Varanasi, UP, India

Neeta Singh Department of Biochemistry, AIIMS, New Delhi, India

xiv Contributors

Shinjini Singh Cytokine Research Laboratory, Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Aru Singh Department of Molecular Medicine and Biotechnology, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, India

Abhishek Tyagi Division of Molecular Oncology, Institute of Cytology and Preventive Oncology (ICMR), Noida, UP, India

Department of Molecular Oncology, B.R. Ambedkar Centre for Biomedical Research (ACBR), University of Delhi, New Delhi, India

Amit Kumar Tyagi Cytokine Research Laboratory, Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Hima V. Vangapandu Department of Experimental Therapeutics, Unit 1950, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Graduate School of Biomedical Sciences, The University of Texas, Houston, TX, USA

Kanchan Vishnoi Division of Molecular Oncology, Institute of Cytology and Preventive Oncology (ICMR), Noida, UP, India

School of Biotechnology, Banaras Hindu University, Varanasi, UP, India

LiXin Yang Cytokine Research Laboratory, Department of Experimental Therapeutics, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

Seong Woo Yoon, M.D.(K.M.D.), Ph.D. Kyung Hee University Hospital at Gangdong, Seoul, Korea

Department of Clinical Oncology, College of Korean Medicine, Kyung Hee University, Seoul, Korea

Contents

Part	t I Genetics/Genome/Microenvironment	
1	Diversity of Chromosomal Characteristics Among Mammals: With Special Reference to Laboratory Mouse in Cancer Research Sen Pathak	3
2	Genome-Based Multi-targeting of Cancer: Hype or Hope? Shinjini Singh, Amit Kumar Tyagi, Sasha Raman, Jiamin Huang, Lokesh Deb, Qaisar Manzoor, Arfaa Sajid, LiXin Yang, Jagnyeswar Ratha, Sahdeo Prasad, and Bharat B. Aggarwal	19
3	Chronic Lymphocytic Leukemia at the Genomic Level	57
4	Apoptosis Pathways in Chronic Lymphocytic Leukemia: Role of the Microenvironment and Therapeutic Strategies Viralkumar Patel, Kumudha Balakrishnan, and Varsha Gandhi	73
5	Tumor-Associated Macrophages in Tumor Progression: From Bench to Bedside	99
6	Role of Osteopontin in Tumor Microenvironment: A New Paradigm in Cancer Therapy	113
Par	t II Tumor Growth/Progression	
7	TG2: Player That Dictates the Rules in Cancer Progression Kapil Mehta and Santosh Kumar	129

vi

8	Role of Surfactants in Regulation of Cancer Growth	137
9	Human Albuminome: Reflections of Neoplastic Transformation and Cancer Detection Through Albumin-Associated Biomarkers Gaganjot Singh Kalsey	151
Part	t III Cancer in India and Approaches	
10	Integrated Cancer Screening Strategies in India	167
11	Gall Bladder Cancer: What Needs to Be Done in India? Vinay K. Kapoor	179
12	Current Treatment for Gallbladder Cancer	189
13	Prevalence of Gastrointestinal Cancers in India	217
Par	t IV Targets and Therapeutics	
14	Personalized Therapeutic Strategies for Epithelial Ovarian Cancer	235
15	Tumor Angiogenesis and Novel Vascular Endothelial Receptor (VEGFR)-Specific Small Molecule Inhibitors	245
16	Targeting Mitochondria: A Powerhouse Approach to Cancer Treatment	263
17	Designing of Tumor-Targeted HuR siRNA Nanoparticle as a Therapeutic for Lung Cancer	277
18	Therapeutic Anticancer Approaches Targeting Telomerase and Telomeres	295
19	Role of Inositol Triphosphate Receptor in Cancer and Its Targeting Through Autophagy Aru Singh, Megha Chagtoo, Bandana Chakravarti, and Madan M. Godbole	311

Contents

20	DNA Topoisomerase II: Promising Target for Anticancer Drugs	323
21	Chemopreventive and Anticancer Efficacy of Silibinin Against Colorectal Cancer	339
22	Integrating Traditional Korean Medicine into Modern Cancer Care	351
23	Seizing Cancer Completely Through Specific Ablating Cancer Stem Cell: The Royal Road to Chemoquiescence	365
24	Cervical Cancer Stem Cells and Their Association with Human Papillomavirus: Are They Ready as Anticancer Targets?	377
25	Integrative Oncology: Scientific Research in Support of Patients: Useful, Possible, Valid	401



Part I Genetics/Genome/Microenvironment