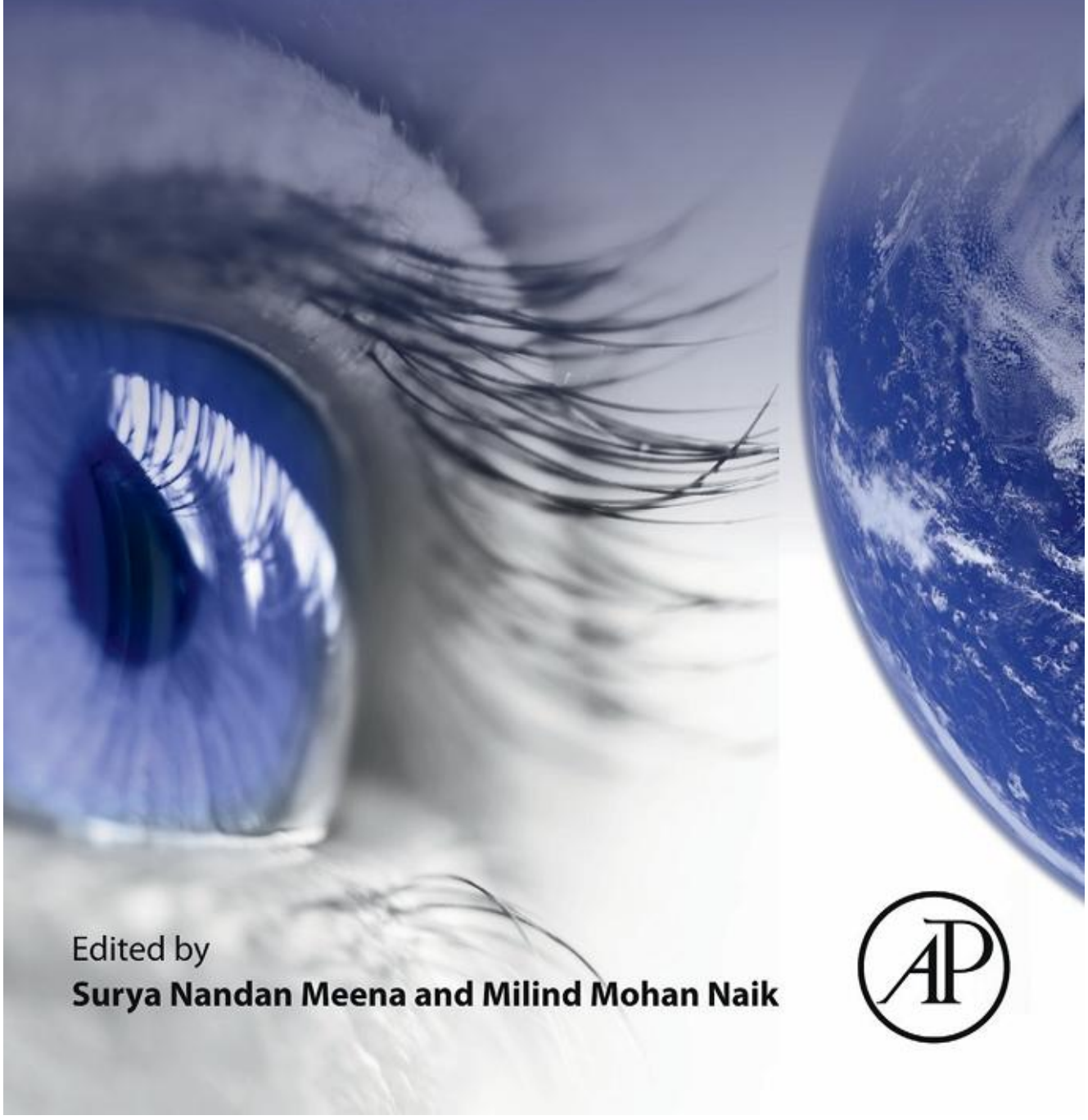
Advances in Biological Science Research

A Practical Approach



Edited by
Surya Nandan Meena and Milind Mohan Naik

Advances in Biological Science Research

A Practical Approach

Edited by

Surya Nandan Meena
Biological Oceanography Division, National Institute of Oceanography, Dona Paula, Goa, India

Milind Mohan Naik
Department of Microbiology, Goa University, Goa, India

ACADEMIC PRESS
An imprint of Elsevier

Academic Press is an imprint of Elsevier
125 London Wall, London EC2Y 5AS, United Kingdom
525 B Street, Suite 1650, San Diego, CA 92101, United States
50 Hampshire Street, 5th Floor, Cambridge, MA 02139, United States
The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, United Kingdom

Notices

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our understanding, changes in research methods, professional practices, or medical treatment may become necessary.

Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds, or experiments described herein. In using such information or methods they should be mindful of their own safety and the safety of others, including parties for whom they have a professional responsibility.

To the fullest extent of the law, neither the Publisher nor the authors, contributors, or editors, assume any liability for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions, or ideas contained in the material herein.

Library of Congress Cataloging-in-Publication Data
A catalog record for this book is available from the Library of Congress

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

ISBN: 978-0-12-817497-5

Publisher: Andre G. Wolff
Acquisition Editor: Linda Versteeg-buschman
Editorial Project Manager: Sandra Harron
Production Project Manager: Poulouse Joseph
Cover Designer: Vicky Pearson Esser

Typeset by TNQ Technologies

Contents

Chapter 21

Role of nanoparticles in advanced biomedical research

R.K. Kunkalekar[1], Umesh B. Gawas[2]
[1]*Department of Chemistry, Goa University, Taleigao Plateau, Goa, India;* [2]*Department of Chemistry, Dnyanprassarak Mandal's College and Research Centre, Assagao, Goa, India*

21.1 Introduction

Nanotechnology refers to the branch of science and engineering dedicated to materials with dimensions in the range 1−100 nm. Nanoparticles (NPs) are of great scientific interest as they are effectively a bridge between bulk materials and atomic or molecular structures. Morphological and topographical features of NPs play important roles in their potential applications in various fields like biomedical, optical, storage system, magnetic separation, targeted drug delivery, electronics, etc. Consequently, with a wide range of applications available, NPs have the potential to make a significant impact on society. The characteristic feature of NPs is that the physical and chemical properties are significantly different from bulk counterparts [1]. In the case of magnetic nanomaterials, the quantum size effects and large surface area dramatically changes their magnetic behavior and they exhibit superparamagnetic phenomena with quantum tunneling of magnetization because at nanodimensions below a critical size each particle behaves as a single magnetic domain [2]. The research associated with nanomaterials in the biological field is mostly directed toward their use in medical diagnosis and treatment of cancer-related ailments. The potential for drug delivery systems involving NPs offers several advantages such as (1) the ability to target specific locations in the body; (2) reduction of the drug quantity needed to attain a particular concentration in the vicinity of the target cells; and (3) reduction of the concentration of the drug in the normal cells to minimize the severity of size effects [3]. This chapter gives an overview of NPs in advanced biomedical research. The biomedical roles of metallic, nonmetallic (metal oxide NPs), and carbon-based nanomaterials with special reference to cancer diagnosis and treatment have been discussed.

Advances in Biological Science Research. https://doi.org/10.1016/B978-0-12-817497-5.00021-5