

# **Environmental Chemistry for a Sustainable World**

Volume 47

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Vinod Kumar Yata • Shivendu Ranjan  
Nandita Dasgupta • Eric Lichtfouse  
Editors

# Nanopharmaceuticals: Principles and Applications Vol. 2

 Springer

### *Editors*

Vinod Kumar Yata  
Animal Biotechnology Centre  
National Dairy Research Institute  
Karnal, India

Nandita Dasgupta  
Department of Biotechnology  
Institute of Engineering and Technology  
Lucknow, Uttar Pradesh, India

Shivendu Ranjan  
Faculty of Engineering and Built  
Environment  
University of Johannesburg  
Johannesburg, South Africa

Eric Lichtfouse  
CNRS, IRD, INRAE, Coll  
France, CEREGE  
Aix-Marseille University  
Aix-en-Provence, France

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# Preface to the Second Volume

The past decade has witnessed tremendous progress in the research of nanopharmaceuticals. While the first volume of the book covered the basic principles and some applications of the nanopharmaceuticals, the second volume covers topics on drug delivery and toxicity of the nanopharmaceuticals, primarily focusing on environment-friendly herbal and natural nanopharmaceuticals for health and environmental applications. We hope that this updated version of the volume will continue to be useful.

Chapter 1 describes the systemic toxicity and environmental effects of nanocarriers used in nanopharmaceuticals, focusing on in vivo biodistribution of nanopharmaceuticals which could help to understand the toxicity of conventional nanocarriers like metal nanoparticles and carbon nanoparticles. It also discusses future guidelines for the development of nanopharmaceuticals.

Chapter 2 consists of two parts: the first part deals with the phytochemicals and their targeting strategies for the treatment of various types of cancers, while the second part describes the applications of different types of herbal nanostructures for cancer treatment. This chapter provides recent research in herbal nanocarriers in cancer therapy which could be helpful in developing risk-free cancer treatment.

Chapter 3 is a worthy compilation of nanopharmaceuticals in drug delivery and targeting. It deals with the passive and active targeting of nanopharmaceuticals and focuses on principles and applications of current research on topical nanopharmaceuticals like carbon nanotubes, quantum dots, nano-shells, etc. This chapter discusses Food and Drug Administration (FDA)-approved nanopharmaceuticals.

Chapter 4 is a comprehensive summary of therapeutic natural products and their encapsulation in nanocarriers which are synthesized from natural products like chitosan, alginate, gelatin, etc. It presents a brief introduction about the different types of nanocarriers and a detailed note on natural products like paclitaxel, doxorubicin, curcumin, etc. and explores the current research on natural products as drugs as well as drug carriers.

Chapter 5 deals with transdermal delivery of therapeutic agents by vesicular carriers and discusses brief introduction to skin anatomy and physiology which is helpful in understanding and developing novel carrier systems for skin delivery. It

thoroughly discusses methods, mechanisms, and applications of different types of vesicular nanocarriers.

Chapter 6 is an inclusive review on nano-delivery platforms for phytochemicals and applications of nano-phytochemicals. It lucidly explains the applications of nano-phytochemicals as anti-inflammatory and anticancer agents and covers a brief section on nanocosmeceuticals.

Chapter 7 describes the emerging applications of nanopharmaceuticals in drug delivery, cell imaging, and treatment of diseases like cancer and AIDS. It also focuses on potential health and environmental risks of nanopharmaceuticals. It concludes with a discussion on future research direction.

Chapter 8 reviews the mode of action and ecotoxicity of the nanopharmaceuticals in aquatic environment. It covers the topic on production of nanopharmaceuticals by using biotechnology methods and also describes the environmental risk assessment of nanopharmaceuticals.

Chapter 9 is a valuable summary on recent advances in nanopharmaceuticals for drug delivery. The first part of this chapter covers the types, composition, structure, and methods of preparation, while the second part covers the recent applications with challenges associated with the use of nanomaterials in pharmaceutical formulations.

Karnal, India  
Johannesburg, South Africa  
Lucknow, Uttar Pradesh, India  
Aix-en-Provence, France

Vinod Kumar Yata  
Shivendu Ranjan  
Nandita Dasgupta  
Eric Lichtfouse

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## About the Editors



**Dr. Vinod Kumar Yata** is an Interdisciplinary Researcher working in the National Dairy Research Institute, Karnal, India. Previously, he worked as an Assistant Professor in the Department of Biotechnology, Dr. B.R. Ambedkar National Institute of Technology Jalandhar, Punjab, India. He received his PhD in Biotechnology from Indian Institute of Technology Guwahati. He specializes in interdisciplinary research which includes nanotechnology, microfluidics, biotechnology, cancer biology, and bioinformatics. He has developed a microfluidic device for the separation of live and motile spermatozoa from cattle semen samples. He opened up a new avenue to prodrug enzyme therapy by introducing the nanocarriers for the delivery of non-mammalian prodrug-activating enzymes. He elucidated the structural features and binding interactions of several biomolecules by *in silico* methods. He has published several research papers in peer-reviewed international journals and presented papers in several international conferences.



**Dr. Shivendu Ranjan** has completed his BTech and PhD in Biotechnology from VIT University, Vellore, India, and has expertise in Nano(bio)technology. He was elected as a Fellow (FLS) of the oldest active biological society started in 1778, The Linnean Society (London), and elected as Fellow of Bose Scientific Society (FBSS). In 2018 he was elected as Fellow of Indian Chemical Society (FICS) – a society founded in 1924. He has also been elected as Fellow (FIETA) of the Indian Engineering Teachers Association. Currently, he is Senior Research Associate at the Faculty of Engineering and Built Environment, University of Johannesburg, Johannesburg, South Africa. Recently he has accepted the role of Strategic Head, Research and Development at Ennoble IP, Noida, India. He is also Visiting Faculty at the National Institute of Pharmaceutical Education and Research-R (NIPER-R), Lucknow. He is Vice President, Indian Chemical Society North Branch. Earlier, he has worked as Scientist at DST-Centre for Policy Research, Lucknow, supported by Ministry of Science and Technology, Government of India. He was also Head, Research and Technology Development at E-Spin Nanotech Pvt. Ltd., SIDBI Incubation Center, Indian Institute of Technology, Kanpur, India. After joining E-Spin Nanotech, IIT Kanpur, he has successfully developed prototypes for many products, has applied one patent and has taken lead in the DSIR Certification for R&D Unit of E-Spin Nanotech Pvt Ltd. He is also Advisor for many companies, such as Eckovation Solutions Pvt Ltd. (IIT Delhi–based start-up), Chaperon Biotech Pvt Ltd (IIT Kanpur–based start up), Kyntox Biotech India Pvt Ltd., and Xcellogen Biotech Pvt Ltd. Dr. Shivendu is also reviewer of Iran National Science Foundation (INSF), Tehran, Iran, and jury at Venture Cup, Denmark, for the past 3 consecutive years. He had founded and drafted the concept for the first edition of the “VIT Bio Summit” in 2012, and the same has been continued till date by the university. He is Associate Editor of Environmental Chemistry Letters (Springer journal of 4.6 impact factor), Section Editor of Pharmaceutical Nanotechnology (Bentham Science, UAE), Editor of Journal of the Indian Chemical Society and editorial board member of Biotechnology and Biotechnological Equipment (Taylor and Francis, USA). He is Advisory Board Member in Elsevier to provide feedback on the new prototypes of Elsevier, Netherlands. He serves as Executive Editor of a journal in

iMed Press, USA, and also as an editorial board member and referee for reputed international peer-reviewed journals. He has published several scientific articles as well as books and has h-index of 21. He has bagged several awards and recognition from several national as well as international organizations.



**Dr. Nandita Dasgupta** has completed her BTech and PhD from VIT University, Vellore, India, and is Elected Fellow (FBSS) of Bose Science Society. She has major working experience in micro-/nanoscience and currently works as Assistant Professor in the Department of Biotechnology, Institute of Engineering and Technology, Lucknow, India. Earlier at LV Prasad Eye Institute, Bhubaneswar, India, she has worked on mesenchymal stem cell-derived exosomes for the treatment of uveitis. She has exposure of working at university, research institutes, and industries including VIT University, Vellore, Tamil Nadu, India; CSIR-Central Food Technological Research Institute, Mysore, India; and Uttar Pradesh Drug & Pharmaceutical Co. Ltd., Lucknow, India; and Indian Institute of Food Processing Technology (IIFPT), Thanjavur, Ministry of Food Processing Industries, Government of India. At IIFPT, Thanjavur, she was involved in a project funded by a leading pharmaceutical company, Dr. Reddy's Laboratories, and has successfully engineered micro-vehicles for model drug molecules. Her areas of interest include micro-/nanomaterial fabrication and its applications in various fields – medicine, food, environment, and biomedical agriculture.

She has published 13 edited books and 1 authored book with Springer, Switzerland, and 2 with CRC Press, USA. She has finished a contract of three book volumes with Elsevier, one with Wiley, two book volumes with CRC Press, and one with RSC (UK). She has authored many chapters and also published many scientific articles in international peer-reviewed journals. She has received the Certificate for “Outstanding Contribution” in Reviewing from Elsevier, Netherlands. She has also been nominated for advisory panel for Elsevier Inc., Netherlands. She is the Associate Editor of *Environmental Chemistry Letters* – a Springer journal of 3.2

impact factor – and also serves as Editorial Board Member and Referee for reputed international peer-reviewed journals. She has received several awards and recognitions from different national and international organizations.



**Dr. Eric Lichtfouse, PhD**, born in 1960, is an Environmental Chemist working at the University of Aix-Marseille, France. He has invented carbon-13 dating, a method allowing to measure the relative age and turnover of molecular organic compounds occurring in different temporal pools of any complex media. He is teaching scientific writing and communication and has published the book *Scientific Writing for Impact Factor Journals*, which includes a new tool – the micro-article – to identify the novelty of research results. He is Founder and Chief Editor of scientific journals and series in environmental chemistry and agriculture. He has founded the European Association of Chemistry and the Environment. He received the Analytical Chemistry Prize by the French Chemical Society, the Grand Prize of the Universities of Nancy and Metz, and the Journal Citation Award by the Essential Indicators.

# Contributors

**Amiti** Department of Biosciences, Department of Biotechnology, School of Biosciences and Technology, Vellore Institute of Technology, Vellore, Tamil Nadu, India

**Adewale Adewuyi** Department of Chemical Sciences, Redeemer's University, Ede, Osun State, Nigeria

**Oluyomi Stephen Adeyemi** Department of Biochemistry, Medicinal Biochemistry, Nanomedicine and Toxicology Laboratory, Landmark University, Omu-Aran, Kwara State, Nigeria

**Thamir Alshammari** Saudi Food and Drug Authority, Riyadh, Kingdom of Saudi Arabia

**André Corrêa Amaral** Institute of Tropical Pathology and Public Health, Federal University of Goiás, Goiás, Brazil

**Keerthic Aswin S** Department of Biosciences, Department of Biotechnology, School of Biosciences and Technology, Vellore Institute of Technology, Vellore, Tamil Nadu, India

**Oluwakemi Josephine Awakan** Department of Biochemistry, Medicinal Biochemistry, Nanomedicine and Toxicology Laboratory, Landmark University, Omu-Aran, Kwara State, Nigeria

**Ana Bastos** iMED.UlIsboa, Research Institute for Medicines, Faculdade de Farmácia, Universidade de Lisboa, Lisbon, Portugal

**Maria João Bebianno** Centre for Marine and Environmental Research (CIMA), University of Algarve, Faro, Portugal

**Lucila Isabel Castro-Pastrana** Departamento de Ciencias Químico-Biológicas, Universidad de las Américas Puebla, Puebla, México

**Pablo Crespo-Morán** Departamento de Ciencias Químico-Biológicas, Universidad de las Américas Puebla, Puebla, México

**Sameh Hosam Abd El-Alim** Pharmaceutical Technology Department, National Research Centre, Cairo, Egypt

**Md Faiyazuddin** Nano Drug Delivery, Maryland, USA

**Mariana Figueira** iMED.ULisboa, Research Institute for Medicines, Faculdade de Farmácia, Universidade de Lisboa, Lisbon, Portugal

**Jessica Andrea Flood-Garibay** Departamento de Ciencias Químico-Biológicas, Universidad de las Américas Puebla, Puebla, México

**Leonor Fonseca** CBiOS, Research Center for Biosciences & Health Technologies, ULHT, Lisbon, Portugal

**Manashjit Gogoi** Department of Biomedical Engineering, North-Eastern Hill University, Shillong, Meghalaya, India

**Ana Grenha** Centre for Marine Sciences (CCMar), University of Algarve, Faro, Portugal

**Ahmed Alaa Kassem** Pharmaceutical Technology Department, National Research Centre, Cairo, Egypt

**Joana Macedo** iMED.ULisboa, Research Institute for Medicines, Faculdade de Farmácia, Universidade de Lisboa, Lisbon, Portugal

**Mrityunjay Mahato** Physics Division, Department of Basic Sciences and Social Sciences, North-Eastern Hill University, Shillong, Meghalaya, India

**Venkatraman Manickam** Department of Biosciences, Department of Biotechnology, School of Biosciences and Technology, Vellore Institute of Technology, Vellore, Tamil Nadu, India

**Miguel Ángel Méndez-Rojas** Departamento de Ciencias Químico-Biológicas, Universidad de las Américas Puebla, Puebla, México

**Aracely Angulo Molina** Departamento de Ciencias Químico-Biológicas/DIFUS, Universidad de Sonora, Hermosillo, Sonora, México

**Jesús Molpeceres** Department of Biomedical Sciences, Faculty of Pharmacy, Universidad de Alcalá, Alcalá de Henares, Spain

**Ana Henriques Mota** iMED.ULisboa, Research Institute for Medicines, Faculdade de Farmácia, Universidade de Lisboa, Lisbon, Portugal

**David Adeiza Othinoi** College of Medicine, All Saints University, Belair, Saint Vincent and the Grenadines

**Chiagoziem Anariochi Otuechere** Department of Biochemistry, Redeemer's University, Ede, Osun State, Nigeria

**Rajeeva Lochana Panchangam** Department of Biosciences, Department of Biotechnology, School of Biosciences and Technology, Vellore Institute of Technology, Vellore, Tamil Nadu, India

**Sanjukta Patra** Department of Biosciences and Bioengineering, Indian Institute of Technology-Guwahati, North Guwahati, Assam, India

**Catarina Pinto Reis** iMED.Ulisboa, Research Institute for Medicines, Faculdade de Farmácia, Universidade de Lisboa, Lisbon, Portugal  
IBEB, Biophysics and Biomedical Engineering, Faculdade de Ciências, Universidade de Lisboa, Lisbon, Portugal

**João F. Pinto** iMED.Ulisboa, Research Institute for Medicines, Faculdade de Farmácia, Universidade de Lisboa, Lisbon, Portugal

**Jorge Filipe Pontes** Centre for Marine Sciences (CCMar), University of Algarve, Faro, Portugal

**Dulce Alitzel Quintana-Romero** Departamento de Ciencias Químico-Biológicas, Universidad de las Américas Puebla, Puebla, México

**Md Akhlaquer Rahman** College of Pharmacy, Taif University, Taif, Kingdom of Saudi Arabia

**Jatinder Kumar Ratan** Department of Chemical Engineering, Dr. B. R. Ambedkar National Institute of Technology Jalandhar, Jalandhar, Punjab, India

**Patrícia Rijo** CBiOS, Research Center for Biosciences & Health Technologies, ULHT, Lisbon, Portugal

iMED.Ulisboa, Research Institute for Medicines, Faculdade de Farmácia, Universidade de Lisboa, Lisbon, Portugal

**Thiago Lopes Rocha** Institute of Tropical Pathology and Public Health, Federal University of Goiás, Goiás, Brazil

**Ana Santos-Rebelo** CBiOS, Research Center for Biosciences & Health Technologies, ULHT, Lisbon, Portugal

Department of Biomedical Sciences, Faculty of Pharmacy, Universidad de Alcalá, Alcalá de Henares, Spain

**Vaishnavi Sundar** Department of Biosciences, Department of Biotechnology, School of Biosciences and Technology, Vellore Institute of Technology, Vellore, Tamil Nadu, India

**Ramasamy Tamizhselvi** Department of Biosciences, Department of Biotechnology, School of Biosciences and Technology, Vellore Institute of Technology, Vellore, Tamil Nadu, India

**Priyanshu Verma** Department of Biotechnology, Bansal Institute of Engineering and Technology, Lucknow, Uttar Pradesh, India

**Mohammad Yusuf** College of Pharmacy, Taif University, Taif, Kingdom of Saudi Arabia