Nanomaterials and the Nervous System

Deniz Eren Erisen
Nanjing University of Aeronautics and Astronautics, China

Kadir Uludag
Shanghai Jiao Tong University, China

Nafees Ahmad
Central South University, China

IGI Global
Publishing Tomorrow's Research Today

Published in the United States of America by
IGI Global
701 E. Chocolate Avenue
Hershey PA, USA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: https://www.igi-global.com

Library of Congress Cataloging-in-Publication Data

CIP PENDING

ISBN13: 979-8-3693-3065-4
Isbn13Softcover: 979-8-3693-7266-1
EISBN13: 979-8-3693-3066-1

Vice President of Editorial: Melissa Wagner
Managing Editor of Acquisitions: Mikaela Felty
Managing Editor of Book Development: Jocelynn Hessler
Production Manager: Mike Brehm
Cover Design: Phillip Shickler

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

All work contributed to this book is new, previously-unpublished material.
The views expressed in this book are those of the authors, but not necessarily of the publisher.

To Ayşenur Ezgi Eygi,

In memory of your unwavering courage and dedication to human rights. Her act will never be forgotten. This book is dedicated to her, a beacon of hope and justice.

Rest in peace, sister. You will never be forgotten.

Ayşenur Ezgi Eygi (27 July 1998 – 6 September 2024) was a Turkish-American human rights activist and peer mentor. Born in Antalya, Türkiye, she graduated from the University of Washington with a psychology major. Tragically, Ayşenur died on 6 September 2024

Table of Contents

Detailed Table of Contents

In previous work, the author demonstrated that two-thirds of the miRNA expressions associated with asbestos exposure in mesothelioma, especially the oncogenic miRNAs, are similarly expressed in schizophrenia brain tissue. No epidemiological evidence links schizophrenia to asbestos, a naturally occurring material often small enough to qualify as a nanoparticle (NP). This review investigated whether any microscopic study of brain tissue in schizophrenia observed inflammatory NPs of any chemical composition. Transmission electron microscopy (TEM) combined with x-ray energy dispersive spectroscopy is the accepted method for identifying the smallest NPs. However, the review found that no TEM study has used sufficient methods to identify NPs in schizophrenia brain tissue. The review also shows that schizophrenia risk is associated with urban air pollution and neuroinflammation and that NPs in urban air pollution can cause neuroinflammation. Research in this unexplored area of schizophrenia neuropathology may reveal new environmental exposures that might cause schizophrenia.

Nanomaterials, with their unique physical and chemical properties, have attracted much interest across various industries. However, their potential to traverse biological barriers and interact with the delicate nervous system raises concerns about neurotoxicity. This chapter explores the mechanisms of nanomaterial-induced neurotoxicity, highlighting the vulnerability of the nervous system and the potential routes of exposure. It provides an overview of established methodologies for assessing neurotoxicity, presents case studies, and experimental findings that underline the importance of rigorous evaluation. Strategies for safer nanomaterial development, including surface modification and biogenic fabrication are discussed. Additionally, the chapter emphasizes the need for robust regulatory frameworks and international collaboration to ensure the responsible development and application of nanomaterials, particularly in the discipline of nanomedicine.

The affected arteries through any disorder get hardened due to plaque formation in cardiac issues. The proliferation of fatty substances in arteries causes stenosis. To access inaccessible areas of the human body, the delivery of nanoparticles tempts to further investigate the function of fluid dynamics in the dispersion of nanoparticles. This study hypothesizes the flow of blood containing nanoparticles via an artery having stenosis and permeable walls along with the consequences of slip velocity. For stenosed tubes, the introduction of nanoparticles has unfavorable effects. Non-linear coupled equations are resolved using the Homotopy Perturbation Method. The application of Laplace and finite Hankel transformations results in a thorough quantitative analysis of fluid acceleration. In case of mild stenosis, the coupled non-linear equations are calculated with the help of the Homotopy Perturbation Method by using appropriate corresponding boundary conditions. The flow rate and shear stress are measured at the constricted region of the tube.

Nanomaterials are widely used across various industries. In addition, nanomaterial emissions are generated from numerous devices and equipment, especially motor vehicles. Despite their benefits, the rapid increase and spread of anthropogenic nanomaterials have raised concerns about nanotoxicity. Recent research indicates that nanomaterials can enter the human body through various pathways and may cause adverse effects, particularly on the central nervous system. The earthquakes in southeastern Turkey on February 6, 2023, have highlighted the 'Lowlands to Mountains' settlement model, which involves relocating communities from loose alluvial soils to stable bedrock areas. This model also presents a promising approach to mitigating the risks associated with atmospheric nanomaterials. By moving urban areas from lowlands to higher altitudes, such as mountains, hills, or slopes—where nanoparticle concentrations may be lower—the health impacts of nanomaterials might be reduced.

Section 2
Technology

Numerous interdisciplinary fields, including nanomedicine, diagnostics, and nanotheranostics, have seen the extensive use of nanotechnology in biomedical engineering. This chapter will give a quick overview of nanotechnology's role as a tool that facilitates the creation of novel functional materials and medical devices here. Quantum dots, or semiconductor nanocrystals, are widely utilized in optical imaging for the diagnosis of conditions like cancer. Nanomaterials have potential applications as treatments and as preventative antiviral/antibacterial agents. In a similar vein, some nanomaterials have demonstrated the ability to circumvent the limitations of traditional antiviral medications. However, it's becoming more important to evaluate the negative impacts and toxicities of nanoparticles in medicine and treatments. The importance of nanoparticles in combating coronavirus disease is highlighted in this article's conversation of the most recent advancement in nanomaterials.

This chapter delves into the transformative potential of nanotechnology in neurological theranostics, examining current diagnostic challenges and emerging trends in nanomedicine. It highlights the limitations of conventional methods and underscores the need for innovative solutions. From nanoscale biosensors for early disease detection to targeted drug delivery systems overcoming the blood-brain barrier, nanotechnology offers novel strategies for enhanced patient care. However, addressing validation, standardization, scalability, and safety concerns is crucial. By fostering interdisciplinary collaborations, integrating nano biomaterials holds promise for personalized neuro-theranostics, improving outcomes for individuals with neurological disorders.

Depression is commonly linked to heightened levels of pro-inflammatory markers, emphasizing the importance of addressing this aspect for effective treatment. Current treatment options encompass selective serotonin reuptake inhibitors (SSRIs), serotonin-norepinephrine reuptake inhibitors (SNRIs), and bioactive compounds from herbal medicine with antidepressant properties. Nevertheless, ensuring adequate drug levels in the brain regions affected by depression poses a challenge. To surmount this obstacle, leveraging drug delivery systems capable of breaching the blood-brain barrier (BBB) has emerged as a promising strategy for administering antidepressants. Nanoformulations (NFs) have shown promise in this regard, facilitating the delivery of antidepressant agents. This examination offers an outline of nose-to-brain delivery using NFs for treating depression, with a focus on enhancing anti-inflammatory and antioxidant effects.

An extensive variety of etiologies, including trauma and chronic health issues, can result in peripheral nerve injuries. These injuries provide significant hurdles regarding clinical care and the eventual restoration of usual ability. In response to these obstacles, nanoparticles have become a viable therapeutic approach that has the potential to accelerate peripheral nerve regeneration. This chapter includes a thorough examination of the categories and synthetic processes related to nanoparticles. Here, the chapter will illustrate the critical role that nanoparticles play in advancing the field of peripheral nerve regeneration through this comprehensive investigation.

Preface

The convergence of nanotechnology and neuroscience represents one of the most exciting frontiers in modern science. The potential to manipulate materials at the nanoscale to interact with the nervous system opens up new avenues for understanding brain function, diagnosing neurological disorders, and developing innovative treatments.

Nanomaterials and the Nervous System is born out of a desire to explore these possibilities in depth. This book brings together the latest research and developments and providing a comprehensive overview of how nanomaterials can be utilized to address some of the most pressing challenges in neuroscience.

The journey of compiling this book has been both enlightening and inspiring. It has involved the collaboration of numerous experts who have generously shared their knowledge and insights. Throughout the chapters, readers will find detailed discussions on a variety of topics, including the design and synthesis of nanomaterials, their interaction with neural tissues, and their potential applications in neurotherapy and diagnostics.

In chapter 1, the authors delve into the intricate issue of nanomaterial neurotoxicity, emphasizing the potential risks these materials pose to the central nervous system. Nanomaterials, characterized by their dimensions ranging from 1 to 100 nanometers, exhibit properties that render them highly valuable across various industrial applications. Despite their benefits, their ability to traverse the blood-brain barrier through different pathways raises significant concerns. The chapter reviews existing research highlighting the adverse effects of nanomaterial exposure, such as oxidative stress, inflammation, and alterations in gene expression. Understanding the mechanisms and influencing factors behind nanomaterial neurotoxicity is essential for the safe application of these materials across diverse fields.

Chapter 2 provides a comprehensive review of nanomaterial neurotoxicity, focusing on the evaluation of toxicity levels, exposure routes, and mechanisms of damage to brain cells. The discussion extends to various models used for assessing neurotoxicity, including in vitro, ex vivo, and in vivo approaches. Challenges related

to nanomaterial characterization, risk assessment, and regulatory frameworks are addressed. The chapter concludes by emphasizing the importance of predictive toxicological models and safe-by-design principles. Future research directions are proposed to explore the long-term effects of nanomaterials and strategies to mitigate their neurotoxic impact.

Building on previous work that linked miRNA expressions associated with asbestos exposure in mesothelioma to schizophrenia brain tissue, chapter 3 explores the potential connection between asbestos, a material that can be considered a nanoparticle, and schizophrenia. The review scrutinizes the use of transmission electron microscopy (TEM) for identifying nanoparticles in schizophrenia brain tissue, finding current methods insufficient. The chapter also investigates the role of urban air pollution and neuroinflammation in schizophrenia risk and suggests that further research into environmental exposures might reveal new insights into the neuropathology of schizophrenia.

In chapter 4, the authors explore the mechanisms through which nanomaterials induce neurotoxicity, focusing on the vulnerabilities of the nervous system and potential exposure routes. The chapter provides an overview of established methodologies for assessing neurotoxicity and presents case studies and experimental findings that highlight the importance of thorough evaluation. It discusses strategies for safer nanomaterial development, including surface modification and biogenic fabrication, and underscores the need for robust regulatory frameworks and international collaboration to ensure responsible nanomaterial development and application, especially in nanomedicine.

Chapter 5 examines the influence of stenosis on the dispersion of nanoparticles in the bloodstream, particularly through arteries with plaque formation. By hypothesizing the effects of nanoparticles in stenosed arteries, the chapter employs the Homotopy Perturbation Method to solve non-linear coupled equations and analyze fluid dynamics. The study measures flow rates and shear stress in constricted regions, providing quantitative insights into the impact of nanoparticles on blood flow and the associated challenges in delivering therapeutic agents effectively.

In chapter 6, the authors address the health risks posed by nanomaterial emissions, particularly from motor vehicles and other devices. Despite their advantages, the proliferation of anthropogenic nanomaterials has raised concerns about their toxicity, especially to the central nervous system. The chapter highlights the recent earthquakes in southeastern Turkey as a case study to propose a 'Lowlands to Mountains' settlement model. This model suggests relocating urban areas to higher altitudes to potentially reduce the health impacts associated with atmospheric nanomaterials.

Chapter 7 offers a broad overview of nanotechnology's applications in biomedical engineering, including diagnostics and therapeutic interventions. It discusses the role of quantum dots in optical imaging and the potential of nanomaterials in

treatments and antiviral/antibacterial applications. The chapter emphasizes the need to evaluate the negative impacts and toxicities of nanoparticles, particularly in the context of recent advancements in combating diseases like COVID-19.

In chapter 8, the authors explore the transformative potential of nanotechnology in neurological theranostics. It reviews current diagnostic challenges and emerging trends in nanomedicine, highlighting the limitations of conventional methods and the need for innovative solutions. The chapter discusses nanoscale biosensors for early disease detection and targeted drug delivery systems for overcoming the blood-brain barrier, while also addressing validation, standardization, and safety concerns essential for the advancement of personalized neuro-theranostics.

Chapter 9 reviews the potential of nanoformulations (NFs) in enhancing the delivery of antidepressants across the blood-brain barrier for the treatment of depression. It focuses on the use of NFs to overcome challenges related to drug concentration in affected brain regions and highlights their ability to improve anti-inflammatory and antioxidant activities. The chapter provides an overview of the nose-to-brain delivery systems and their promise in advancing depression treatment.

Chapter 10 investigates the use of nanoparticles as a therapeutic approach to accelerate peripheral nerve regeneration. It provides a thorough examination of nanoparticle categories, synthetic processes, and their roles in advancing nerve regeneration. The chapter underscores the potential of nanoparticles in addressing clinical care challenges and restoring functionality in patients with peripheral nerve injuries.

Focusing on the optimization of nanocomposites for neural applications, chapter 11 discusses how modifying physical and chemical properties can enhance their suitability for supporting neural tissue. It highlights the importance of rigorous testing in evaluating material performance and the potential implications for neural tissue engineering and regenerative medicine. The chapter concludes by discussing the future prospects of Chi-PDA nanocomposites in developing advanced neural interfaces, implants, and scaffolds.

Chapter 12 addresses the current state of knowledge in the design and manufacturing of nanomaterials, focusing on their size, shape, surface charge, and microstructures. It provides a comprehensive analysis of the principles, sample preparation procedures, and characterization techniques used in nanomaterial design. The chapter also briefly covers important applications, such as wound healing, drug delivery, and tissue regeneration.

Chapter 13 explores the relationship between prenatal stress and cognitive impairments in offspring, particularly in women from the Asia-Pacific region who continue to work during pregnancy. It examines how stress affects maternal endocrine homeostasis and the intrauterine environment, impacting fetal brain and nervous system development. The chapter aims to provide insights into the effects

of pregnancy stress on cognitive outcomes in offspring and the need for further research in this area.

As we navigate through the complexities of the nervous system with the aid of nanotechnology, it is crucial to consider not only the scientific and technical aspects but also the ethical and societal implications. This book aims to address these considerations, fostering a holistic understanding of the field.

We hope that *Nanomaterials and the Nervous System* will serve as a valuable resource for researchers, clinicians, and students alike. It is my sincere wish that this book will inspire further research and innovation, ultimately contributing to the advancement of neuroscience and the betterment of human health and psychology. We also aspire that this chapter can motivate individuals to delve deeply into the study of nanomaterials, uncovering the diverse beauty found in nature. The intelligent and aesthetically pleasing design of all things is worthy of exploration and appreciation.

Deniz Eren Erişen
Nanjing University of Aeronautics and Astronautics, China

Kadir Uludag
Shanghai Jiao Tong University, China

Nafees Ahmad
Central South University, China

Section 1
Toxicology

Chapter 1
Neurotoxicity and Biosafety of Nanomaterials

Shadi Askari
Amirkabir University of Technology, Iran

Mahnaz Eskandari
https://orcid.org/0000-0002-8141-7814
Amirkabir University of Technology, Iran

ABSTRACT

This chapter explores the neurotoxicity of nanomaterials, focusing on their potential to induce harmful effects on the central nervous system. Nanomaterials, with dimensions between 1 and 100 nanometers, possess unique properties that make them valuable in various industries. However, their ability to penetrate the brain through different pathways raises concerns about neurotoxicity. Studies have highlighted the adverse effects of nanomaterial exposure, including oxidative stress, inflammation, and gene expression alterations. Understanding the mechanisms and factors influencing nanomaterial neurotoxicity is crucial for ensuring their safe use across diverse applications.

INTRODUCTION

Neurotoxicity poses a considerable risk in evaluating nanomaterials' safety, given the brain's great susceptibility to even small amounts of harmful compounds. Nanomaterials are substances with at least one dimension within the range of 1 to 100 nanometers (nm) (Hussain et al., 2020). Due to their distinct physical and chemical

DOI: 10.4018/979-8-3693-3065-4.ch001

Chapter 2
Toxicology of Nanomaterials With a Special Focus on the Nervous System

Bancha Yingngam
https://orcid.org/0000-0001-7215-9123
Ubon Ratchathani University, Thailand

ABSTRACT

Nanomaterials possess different properties that make them suitable for application in numerous fields. Nonetheless, their toxicity, especially their neurotoxic propensity, is a considerable area of investigation. In this chapter, nanomaterial neurotoxicity is reviewed in detail, with an emphasis on assessing toxicity, levels of exposure or routes of entry to brain cells, mechanisms by which they cause damage, and specific types of damage. In addition, in this chapter, in vitro, ex vivo, and in vivo models used to measure neurotoxicity are described. This chapter provides a discussion of this matter by considering challenges in terms of nanomaterial characterization, risk assessment, and regulatory aspects. This chapter concludes by underscoring the importance of toxicological models of prediction and safe-by-design solutions. Future research should address the long-term effects of using nanomaterials and the means of preventing their neurotoxicity.

DOI: 10.4018/979-8-3693-3065-4.ch002

Chapter 3
A Review of Electron Microscopy Studies of the Brain in Schizophrenia:
In Search of Nanotoxicology From Air Pollution

James S. Brown, Jr.
https://orcid.org/0000-0002-5276-7655
Independent Researcher, USA

ABSTRACT

In previous work, the author demonstrated that two-thirds of the miRNA expressions associated with asbestos exposure in mesothelioma, especially the oncogenic miRNAs, are similarly expressed in schizophrenia brain tissue. No epidemiological evidence links schizophrenia to asbestos, a naturally occurring material often small enough to qualify as a nanoparticle (NP). This review investigated whether any microscopic study of brain tissue in schizophrenia observed inflammatory NPs of any chemical composition. Transmission electron microscopy (TEM) combined with x-ray energy dispersive spectroscopy is the accepted method for identifying the smallest NPs. However, the review found that no TEM study has used sufficient methods to identify NPs in schizophrenia brain tissue. The review also shows that schizophrenia risk is associated with urban air pollution and neuroinflammation and that NPs in urban air pollution can cause neuroinflammation. Research in this unexplored area of schizophrenia neuropathology may reveal new environmental exposures that might cause schizophrenia.

DOI: 10.4018/979-8-3693-3065-4.ch003

Chapter 4
Analysis of Neurotoxic Effects on the Nervous System Induced by Nanoparticles

Amadu Kayode Salau
https://orcid.org/0000-0002-7672-1416
Federal University of Health Sciences, Ila-Orangun, Nigeria

Muhammad Suleiman Shehu
https://orcid.org/0009-0005-8008-1318
Federal University of Health Sciences, Ila-Orangun, Nigeria

Sodiq Oluwaseun Dada
Federal University of Health Sciences, Ila-Orangun, Nigeria

Taiwo Ayodeji Sorunke
https://orcid.org/0009-0005-2125-9032
Federal University of Health Sciences, Ila-Orangun, Nigeria

Adenike Temidayo Oladiji
University of Ilorin, Nigeria

ABSTRACT

Nanomaterials, with their unique physical and chemical properties, have attracted much interest across various industries. However, their potential to traverse biological barriers and interact with the delicate nervous system raises concerns about neurotoxicity. This chapter explores the mechanisms of nanomaterial-induced neurotoxicity, highlighting the vulnerability of the nervous system and the potential

DOI: 10.4018/979-8-3693-3065-4.ch004

Chapter 5
Study of Lipid Concentration Effects on Couple Stress Blood Flow Through Stenosed Tube With Permeable Walls Considering the Effects of Slip Velocity

Jyoti Ghangas
Maharshi Dayanand University, India

Sumeet Gill
Maharshi Dayanand University, India

Rajendra Kumar
https://orcid.org/0000-0002-8427-5428
School of Engineering and Technology, Sharda University, India

ABSTRACT

The affected arteries through any disorder get hardened due to plaque formation in cardiac issues. The proliferation of fatty substances in arteries causes stenosis. To access inaccessible areas of the human body, the delivery of nanoparticles tempts to further investigate the function of fluid dynamics in the dispersion of nanoparticles. This study hypothesizes the flow of blood containing nanoparticles via an artery having stenosis and permeable walls along with the consequences of slip velocity.

DOI: 10.4018/979-8-3693-3065-4.ch005

Chapter 6
Nanomaterials, Neurotoxicity, and Settlement Model From Lowlands to Mountains

Fatih Kara
https://orcid.org/0000-0002-9729-5380
Kafkas University School of Medicine, Turkey

Ece Aslantaş
https://orcid.org/0009-0001-8150-8871
Kafkas University School of Medicine, Turkey

Hamza Eren Tosun
https://orcid.org/0009-0008-1297-4511
Kafkas University School of Medicine, Turkey

Abdulsamet Mavzer
https://orcid.org/0009-0004-2599-6497
Kafkas University School of Medicine, Turkey

ABSTRACT

Nanomaterials are widely used across various industries. In addition, nanomaterial emissions are generated from numerous devices and equipment, especially motor vehicles. Despite their benefits, the rapid increase and spread of anthropogenic nanomaterials have raised concerns about nanotoxicity. Recent research indicates that nanomaterials can enter the human body through various pathways and may cause adverse effects, particularly on the central nervous system. The earthquakes in southeastern Turkey on February 6, 2023, have highlighted the 'Lowlands to

DOI: 10.4018/979-8-3693-3065-4.ch006

Section 2
Technology

Chapter 7
Application of Nanotechnology on Medicine and Biomedical Engineering

P. Selvakumar
https://orcid.org/0000-0002-3650-4548
Nehru Institute of Technology, India

S. Seenivasan
https://orcid.org/0000-0002-2155-9781
Rathinam Technical Campus, India

G. Vijayakumar
Vivekanandha College of Engineering for Women, India

A. Panneerselvam
Vivekanandha College of Engineering for Women, India

A. Revathi
https://orcid.org/0000-0003-4387-2442
Kongu Engineering College, India

ABSTRACT

Numerous interdisciplinary fields, including nanomedicine, diagnostics, and nanotheranostics, have seen the extensive use of nanotechnology in biomedical engineering. This chapter will give a quick overview of nanotechnology's role as a tool that facilitates the creation of novel functional materials and medical devices here. Quantum dots, or semiconductor nanocrystals, are widely utilized in optical

DOI: 10.4018/979-8-3693-3065-4.ch007

Chapter 8
Nano Biomaterials for Neurological Theranostics

Muhammad
https://orcid.org/0000-0001-9642-418X
Hefei Institute of Physical Science, Chinese Academy of Sciences, China

Shereen M. Elsherbiny
Hefei Institute of Physical Science, Chinese Academy of Sciences, China & Mansoura University, Egypt

ABSTRACT

This chapter delves into the transformative potential of nanotechnology in neurological theranostics, examining current diagnostic challenges and emerging trends in nanomedicine. It highlights the limitations of conventional methods and underscores the need for innovative solutions. From nanoscale biosensors for early disease detection to targeted drug delivery systems overcoming the blood-brain barrier, nanotechnology offers novel strategies for enhanced patient care. However, addressing validation, standardization, scalability, and safety concerns is crucial. By fostering interdisciplinary collaborations, integrating nano biomaterials holds promise for personalized neuro-theranostics, improving outcomes for individuals with neurological disorders.

DOI: 10.4018/979-8-3693-3065-4.ch008

Chapter 9
Nose-to-Brain Delivery of Nanoformulations for Treatment of Depression: Focus on Antioxidant and Anti-Inflammatory Pathways

Tahmineh Mokhtari
https://orcid.org/0000-0002-4126-7102
Faculty of Basic Medical Sciences, China

Fatemeh Sheikhbahaei
Kerman University of Medical Sciences, Iran

Maryam Saadat
Semnan University of Medical Sciences, Iran

Kadir Uludag
https://orcid.org/0000-0003-3713-4670
Shanghai Mental Health Center, China

ABSTRACT

Depression is commonly linked to heightened levels of pro-inflammatory markers, emphasizing the importance of addressing this aspect for effective treatment. Current treatment options encompass selective serotonin reuptake inhibitors (SSRIs), serotonin-norepinephrine reuptake inhibitors (SNRIs), and bioactive compounds from herbal medicine with antidepressant properties. Nevertheless, ensuring adequate drug levels in the brain regions affected by depression poses a challenge. To surmount this obstacle, leveraging drug delivery systems capable of breaching the

DOI: 10.4018/979-8-3693-3065-4.ch009

Chapter 10
Revolutionizing Nerve Repair:
The Transformative Role of Nanoparticles in Peripheral Nerve Regeneration

Ranjit Barua
https://orcid.org/0000-0003-2236-3876
Omdayal Group of Institutions, India

Sudipto Datta
IISC Bangalore, India

ABSTRACT

An extensive variety of etiologies, including trauma and chronic health issues, can result in peripheral nerve injuries. These injuries provide significant hurdles regarding clinical care and the eventual restoration of usual ability. In response to these obstacles, nanoparticles have become a viable therapeutic approach that has the potential to accelerate peripheral nerve regeneration. This chapter includes a thorough examination of the categories and synthetic processes related to nanoparticles. Here, the chapter will illustrate the critical role that nanoparticles play in advancing the field of peripheral nerve regeneration through this comprehensive investigation.

DOI: 10.4018/979-8-3693-3065-4.ch010

Chapter 11
Exploring the Potential of Chitosan–Polydopamine Nanocomposites for Neural Tissue Regeneration

Deniz Eren Erisen
https://orcid.org/0000-0003-3416-3732
Nanjing University of Aeronautics and Astronautics, China

ABSTRACT

The chapter discusses the optimization of the physical and chemical properties of these nanocomposites to enhance their suitability for neural applications, such as tuning the surface chemistry to improve cell-material interactions and modifying the mechanical properties to match those of the native neural tissue. It also highlights the importance of rigorous in vitro and in vivo testing to evaluate the material's performance in supporting neural cell viability, differentiation, and integration with host tissue. The potential implications of this research are far-reaching, contributing not only to the advancement of neural tissue engineering but also to the broader scope of regenerative medicine. The chapter concludes with a discussion on the prospects of Chi-PDA nanocomposites in the development of next-generation neural interfaces, implants, and scaffolds, and their potential to significantly improve the quality of life for individuals with neural damage or degenerative conditions.

DOI: 10.4018/979-8-3693-3065-4.ch011

Chapter 12
Application of Nanoparticles on Biomedical Devices

Nipun Jain
https://orcid.org/0009-0008-8270-9449
IISC Bangalore, India

Dileep Pathote
https://orcid.org/0000-0001-8198-175X
IISC Bangalore, India

Yusuf Olatunji Waidi
https://orcid.org/0000-0002-5728-1769
IISC Bangalore, India

Udit Narayan Sharma
https://orcid.org/0000-0003-2564-055X
IIT Roorkee, India

Vilay Vannaladsaysy
National University of Laos, Laos

Sudipto Datta
https://orcid.org/0000-0003-2161-6878
IISC Bangalore, India

ABSTRACT

Creating customized applications for the biological domains has made designing nanomaterials a high research priority. Indeed, existing patterns in the literature indicate an absence of comprehensive evaluations that explicitly highlight the state of knowledge about the design and manufacturing of nanomaterials. The performance of nanoparticles (NPs) is affected by various aspects, including size, shape, surface charge, and microstructures. It has also been discovered that these properties depend on how they are synthesized. The principles, sample preparation procedures, and outcomes of the characterization techniques employed to study these nanomaterials varied somewhat. As a result, this book chapter aims to thoroughly analyze current developments in nanomaterials for biomedical engineering, focusing on the selection

DOI: 10.4018/979-8-3693-3065-4.ch012

Chapter 13
Enhancing Offspring Cognitive Health: Addressing Prenatal Stress and Problems Through Nanotechnology

Yan Hua Bi
Zhejiang University, China

Jiang Po
Cixi Biomedical Research Institute, China

Kadir Uludag
https://orcid.org/0000-0003-3713-4670
Shanghai Jiao Tong University, China

ABSTRACT

With the progress of modern human society, women have entered the workplace and actively participate in work. Especially for women in Asia-pacific area, they persist in working during pregnancy to support their families financially. Consequently, they experience substantial stress when it comes to both their well-being and job responsibilities throughout pregnancy. However, the relationship between pregnancy stress and cognitive impairments in offspring has not been extensively studied. The development of human fetuses and their brains requires a stable and safe environment. The stress experienced by pregnant women can affect the endocrine homeostasis system of the mother and the intrauterine environment, which in turn impacts the fetal brain and the nervous system development. This book chapter aims to explore this relationship between prenatal stress and effects on offspring cognition impairments intensively.

DOI: 10.4018/979-8-3693-3065-4.ch013

About the Contributors

Deniz Eren Erişen is a distinguished researcher in Material Processing Engineering. He earned his PhD from the University of Science and Technology of China (2017-2022), MSc from Nanjing University of Aeronautics & Astronautics (2013-2016), and BSc from Anadolu University (2008-2013). His research focuses on biodegradable metallic biomaterials, bioactive coatings for medical devices, and nanomaterials synthesis and characterization. Dr. Erişen's notable works include studies on the biosafety and biodegradation of AZ31B magnesium alloy carotid artery stents, the development of a novel chitosan and polydopamine interlinked bioactive coating for biomaterials, and the synthesis and characterization of chitosan-copper composite coatings on biomedical devices. His innovative research has significantly advanced these fields, making him a valuable contributor to the scientific community

Kadir Uludag is a distinguished researcher in Applied Psychology. He completed his PhD at the Chinese Academy of Sciences. His research interests encompass schizophrenia, brain imaging, and educational psychology. Dr. Uludag has made significant contributions to these fields through his innovative research. His notable works include studies on the prevalence and risk factors of tardive dyskinesia in schizophrenia patients, which have provided valuable insights into managing this condition.

Nafees Ahmad is a distinguished researcher in Physical Chemistry. He received the CAS-TWAS President's Fellowship Award in 2016 and completed his Ph.D. under the supervision of Prof. Huiqiong Zhou at the CAS Center for Excellence in Nanoscience, National Center for Nanoscience and Technology, Chinese Academy of Sciences. Following his Ph.D., he worked as a Research Fellow at the Tsinghua-Berkeley Shenzhen Institute (TBSI), Tsinghua University. In 2021, Dr. Ahmad joined the research group of Prof. Liang and Prof. Fan at Shenzhen University as a Postdoctoral Fellow, where he earned a Distinction Certificate in the "National

Postdoctoral Innovation & Entrepreneurship Competition." His research during this period focused on advanced nanomaterials and their applications. In 2023, Dr. Ahmad joined Prof. Yingping Zou's group at Central South University as a Postdoctoral Research Fellow. Here, he was awarded the "Postdoctoral Class-B Funding of Central South University" for his innovative research contributions. His work continues to advance the field of Physical Chemistry, particularly in nanoscience and nanotechnology, making him a valuable contributor to the scientific community.

***

Revathi A. has more than 10 years of teaching experience in Engineering College. She completed her M.Sc., at Government Arts College, Coimbatore and M.Phil., Chemistry in Erode Arts and Science College, Erode. She is pursuing Ph.D. in the field of Environmental Science at Kongu Engineering College under Anna university Chennai. She has published more than 10 articles in various reputed international journals. She has presented many papers in international and national conferences organized by various reputed institutions. She received Best Faculty Award in the Department of Chemistry for the Academic year 2020-21. She has organized various national and international webinars and quiz competition for Student community in the field of Chemistry. Her area of interests Supercapacitor, Wastewater treatment, Adsorption, Water Quality Analysis, Photocatalyst etc.,

James S. Brown, Jr., MD, MPH, MS is an independent psychiatric researcher and writer. He is the author of several reviews on schizophrenia, and one book and other articles on the psychiatric effects of chemical exposures. He is a Diplomate of the American Board of Psychiatry and Neurology (# 142528), and has served in several clinical psychiatry positions in U.S. military, Federal, state and local agencies. He obtained his medical degree at Virginia Commonwealth University School of Medicine, and performed his psychiatric residency training at Walter Reed Army Medical Center in Washington, D.C. He has additional degrees in geology, public health, nanotechnology and library science. His current research focuses on the environment and mental health.

Jyoti G. is a Research Scholar in department of Mathematics at Maharshi Dayanand University, Rohtak, India under the supervision of Professor Sumeet Gill. Her research area is biomedical science.

Sumeet Gill is professor in department of Mathematics at Maharshi Dayanand University, Rohtak, India. His research area is neural networks, artificial intelligence, etc.

Fatih Kara is an esteemed academic and researcher affiliated with Kafkas University, where he serves in the Faculty of Medicine, Department of Basic Medical Sciences. He completed his doctoral studies at Atatürk University. Dr. Kara is actively involved in teaching and mentoring students, fostering the next generation of scientists and medical professionals. His dedication to advancing medical knowledge and improving patient care makes him a respected figure in the academic and medical communities.

Rajendra Kumar is Associate Professor in Computer Science & Engineering Department School of Engineering and Technology, Sharda University, Greater Noida, India. His research are includes Vein Pattern Recognition, Biometrics, Human Computer Interaction, and Theoretical Computer Science.

Shereen M. Elsherbiny received her B.Sc. in Biophysics from the Physics Department, Faculty of Science, Mansoura University, Egypt in 2010. She was recruited as a teaching assistant at Physics Department, at Mansoura University (2010–2015). She got her master's degree in biophysics in 2015. She was employed as an assistant lecturer at Mansoura University, Egypt (2015–2019). She obtained her Ph.D. under the supervision of Prof. Huang Qing at the University of Science and Technology of China. Currently, her research focuses on the applications of nanoparticles in photodynamic therapy.

Tahmineh Mokhtari, Ph.D., holds a Ph.D. in Anatomical Sciences from Tehran University of Medical Sciences, where she gained a solid foundation in neuroscience. As an assistant professor at Semnan University of Medical Sciences, she had the opportunity to work closely with students and engage in teaching activities, further developing her passion for academia. In January 2023, she received her second Ph.D. in neuroscience at the University of Chinese Academy of Sciences (UCAS) in Beijing, China. Then, she started working as an associate professor at Hubei University of Medicine in June 2023. Throughout her academic career, Tahmineh has made significant contributions to the field of neuroscience. She has published more than 65 papers in prestigious SCIE indexed journals. Her research primarily focuses on unraveling the cellular and molecular mechanisms underlying the pathogenesis of neuropsychological diseases, with a specific emphasis on neuro-inflammatory signaling pathways in critical brain regions.

Muhammad is a biophysicist affiliated with the prestigious Hefei Institutes of Physical Science, Chinese Academy of Sciences (HFCAS). Having obtained his Ph.D. in 2021 from the University of Science and Technology of China (USTC) with Prof. Qing Huang, his research primarily focuses on pioneering techniques utilizing non-linear vibrational spectroscopy in conjunction with biofunctionalized plasmonic nanomaterials. This approach aims to elucidate radiation inflammation-related immunological biomarkers present in blood and serum samples. Presently, he is exploring the integration of Surface-Enhanced Raman Spectroscopy (SERS) with microfluidics techniques to probe complex diseases such as Alzheimer's disease and early-stage cancer metastasis. This enables him to develop cutting-edge methodologies for probing and analysing disease-specific biomarkers within cells, including miRNAs, exosomal proteins, and key immunological markers such as PD-L1 and integrins. His dedication to advancing scientific knowledge is further demonstrated by his roles as Principal Investigator in national projects funded by the National Natural Science Foundation of China (NSFC) and the Anhui Provincial Government's "The-Fourth One" initiative. Notably, he has also been recognized as a recipient of the Ministry of Science and Technology (MoST) Young Talent Program in 2024. With over 14 SCI papers published in prestigious international journals such as ACS Analytical Chemistry, ACS Applied Nano Materials, and Sensors and Actuators B: Chemical, among others, Muhammad's contributions extend to co-authoring three invention patents related to early-stage cancer diagnosis and the assessment of radiation injury. His unwavering dedication to scientific inquiry and impactful research underscores his commitment to advancing the field of biospectroscopy and diagnosis applications for improving patient outcomes through innovative technologies.

Selvakumar P. is an Associate Professor in the Department of Science and Humanities at Nehru Institute of Technology, Coimbatore, Tamilnadu, India-641105, where he has been since 2023. From 2023 he served as Department IQAC Coordinator. From 2011 to 2023 he served as Assistant Professor of Department of Science and Humanities in Info institute of Engineering and Dr.N.G.P Institute of Technology, Coimbatore, Tamilnadu, India. His area of interest is the field of phytochemistry. His Credit includes 30 Journal publications, 12 patents and 20 conference papers, conducted 5 seminars and conferences and honored with best teacher Awards.

Seenivasan S. is currently working as an Associate Professor Department of Mechanical Engineering at Rathinam Technical Campus, Coimbatore, TamilNadu, India. He completed BE (Mechanical Engineering) in the year of May 2009 at Kumaraguru College of Technology, Coimbatore and ME (Engineering Design)

in the year May 2012 at Anna University Regional campus, Coimbatore. Ph.D (Mechanical Engineering) in the Year 2021 at Anna University, Chennai, in the area of Composite Materials, machine learning, deep learning . He has 12 years of teaching & 5 Years of Research Experience. Orcid id; 0000-0002-2155-9781

Suleiman Muhammad Shehu (born December 14, 1994) is a Nigerian biochemist currently serving as a Graduate Assistant in the Department of Biochemistry at the Federal University of Health Sciences, Ila-Orangun (FUHSI), Nigeria. He earned his BSc in Biochemistry from Ahmadu Bello University Zaria in 2017. Shehu's research spans various aspects of biochemistry and nanotechnology, including investigating the role of nanoparticles in mitigating the effects of advanced glycation end-products (AGEs) and hyperglycemia. Additionally, his work includes reviewing the potential of medicinal plants and polyphenols in dermal protection against UV-induced skin damage. Shehu has presented his research at various scientific conferences, including the 7th International Conference on Nanotechnology in Abuja and the 2nd Annual Scientific Conference of the Society of Basic and Clinical Toxicology. He is single and currently resides in Ila-Orangun, Osun State.

Bancha Yingngam is working as Associate Professor (Pharmaceutical Sciences and Technology) in the Faculty of Pharmaceutical Sciences at Ubon Ratchathani University, Ubon Ratchathani, Thailand. He received his B.Pharm. and Ph.D. (Pharmaceutical Sciences) at the Ubon Ratchathani, and postdoctoral fellowship at Institute of Pharmaceutical Sciences, University of Graz, Graz, Austria. His areas of interest include artificial intelligence, optimization methods, green chemistry, natural product chemistry, cosmeceuticals, and pharmaceutical nanotechnology. He has authored and coauthored many scientific papers published in international journals, and proceedings of international and national scientific conferences. He has also authored more than 30 book chapters and edited three textbooks.

Index

M

N

O

P

R

S

T

Ultrastructure 36, 73, 102

Nanomaterials and the Nervous System

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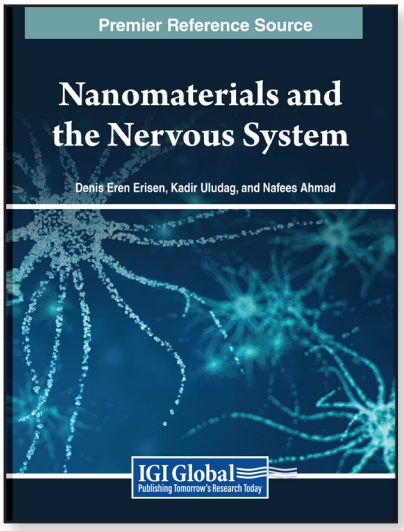

Deniz Eren Erisen (Nanjing University of Aeronautics and Astronautics, China), Kadir Uludag (Shanghai Jiao Tong University, China) and Nafees Ahmad (Central South University, China)

Description:

Nanotechnology is revolutionizing medicine and neuroscience. However, with this innovation comes the concern of the potential risks posed by nanomaterials to the human nervous system. As scientific research progresses, so does the urgency to understand and mitigate these risks. This book offers a multidisciplinary approach to tackle the complexities of nanotechnology's impact on neurological health.

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ISBN: 9798369330654 **Pages:** 320 **Copyright:** 2025 **Release Date:** October, 2024

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