

Nutritional Neurosciences

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This book series aims to publish volumes focusing on both basic and clinical research in the field of nutritional neuroscience with a focus on delineating the effect of nutrition on brain function and behavior. The books will examine the role of different nutrients, food agents and supplements (both macro and micro) on brain health, neurodevelopment, neurochemistry, and behaviour. The books will examine the influence of diet, including phytochemicals, antioxidants, dietary supplements, food additives, and other nutrients on the physiology and metabolism of neurons, neurotransmitters and their receptors, cognition, behavior, and hormonal regulations.

The books will also cover the influence of nutrients and dietary supplements on the management of neurological disorders. It details the mechanism of action of phytonutrients on signaling pathways linked with protein folding, aggregation, and neuroinflammation. The books published in the series will be useful for neuroscientists, nutritionists, neurologists, psychiatrists, and those interested in preventive medicine.

Wael Mohamed • Rajat Sandhir
Editors

Trace Elements in Brain Health and Diseases

 Springer

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It is with genuine gratitude and warm regards that I dedicate this work to Menoufia Medical School: Thank you so much for the unending financial and logistical support during my Ph.D. journey and afterward during my sabbatical leave. I could not do any of this without your love and glory.

Wael Mohamed

Preface

“To study the phenomenon of disease without books is to sail an uncharted sea, while to study books without patients is not to go to sea at all.”

William Osler (1849-1919)

Recently, the impact of nutrition and food intake has been highly investigated to study its impact on our brain function and its development as it was shown that the diet we take will determine the outcome of certain brain disorders such as brain injury and stroke. Along with its effects on cardiovascular diseases and cancer development, nutrition and diet have been shown to be involved in preserving our mental cognitive function and behavior. Recent studies have implicated the development or exacerbation of certain neurological disorders to an imbalance in our nutritional intake and our diet, especially iron. The book *Trace Elements in Brain Health and Diseases* will be published by Springer Nature under the Nutritional Neurosciences series (<https://www.springer.com/series/16639>). The aim of this project is to assemble global perspectives concerning the relationship between trace elements and the brain in health and diseases. This book will be part of the Nutritional Neurosciences series that covers multiple domains within nutritional neuroscience. The inclusion of trace elements in this prestigious series will help introduce new readers to the subdiscipline and increase the number of global conversation partners.

In the human body, trace elements are most plentiful. It is well known that trace elements are an essential component of the body's metabolism. Previous studies have shown that deficiency of various trace elements in the brain triggers mental impairment in infants and young children, for example, verbal and body coordination delays and psychomotor disorders. Therefore, the mechanism and control of brain trace elements metabolism should be researched and understood thoroughly. On this basis, it is important to explore the relationship between brain trace elements control and the incidence of nervous system diseases and discover new metabolism-related therapeutic targets in order to break down the limitation of nervous system disease prevention and treatment.

Trace Elements in Brain Health and Diseases addresses cutting-edge areas of research of high significance for public health and translational medicine. The book discusses the comprehensive research history of trace elements and their significant

role in the pathogenesis of central nervous system (CNS) diseases. The book also identifies how trace elements support function as well as the molecular mechanisms underlying their neuroprotectant activity. This topic is among the most interesting and challenging areas of contemporary translational biological and medical research, with implications for preventive and therapeutic approaches in age-related neurodegenerative disorders. This book explores the molecular mechanisms of brain trace elements including age-related metabolic pathways, mitochondrial nutrients, neurodegeneration and CNS disorders, cell signaling, and neuronal functions.

Coming from a background in the area of neuro-psychiatric health research, the editors (Drs. Mohammed and Sandhir) have decided to collaborate with other colleagues with expertise in areas of nutritional neuroscience to have a comprehensive book entitled *Trace Elements in Brain Health and Diseases*, which included eight chapters.

Overall, this new book provides updated and novel concepts in the field of neurological disorders and their relation to trace elements. The new compilation will be of high interest among researchers and clinical scientists involved in neuropsychiatry, nutrition, and biochemistry.

Finally, we thank all the authors for their significant effort in writing such excellent chapters for this new edition. We are also sincerely grateful to each author for their patience during the compilation and final editing of this book.

Kuantan, Malaysia
Chandigarh, India

Wael Mohamed
Rajat Sandhir

Acknowledgments

First, we would like to express our sincere appreciation to all the authors who contributed to this timely project. The high level of devotion and dedication between the authors and editors made writing this book an enjoyable journey. In addition, we also extend our gratitude to the authors who are in the fields of neurology and neuropsychiatric research for delivering years of their experience and work in different areas of psychiatric disorders to deliver such an elegant piece of work. The topics and applications discussed are of great value in the areas of nutrition, neurological disorders, and neurodegeneration. Finally, we would like to thank many of our friends and colleagues for their unconditional love, encouragement, and inspiration throughout the project. Thank you.

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Rajat Sandhir, MSc, PhD, FIAN, FABMS has received his MSc and PhD degrees in Biochemistry from the Postgraduate Institute of Medical Education and Research, Chandigarh. He has been at the Department of Biochemistry, Panjab University, for more than 20 years. He has 28 years of teaching and research experience. His research interests are to understand the biochemical and molecular mechanisms involved in the development of neurodegenerative conditions like metabolic encephalopathies, dementias and brain injury with a particular interest to investigate the role of oxidative stress, mitochondrial dysfunctions, and alterations in permeability of blood-brain barrier. He has an interest in nutritional neuroscience, particularly about the role of trace elements especially zinc and selenium in the brain. In addition, his interest is also to identify neuroprotective strategies that could ameliorate neurodegenerative conditions. He has over 200 papers to his credit and has mentored over three dozen students for PhD. He has an *h*-index of 49 and *i10* index of 140. He has been on the editorial board of many international journals. He was awarded with “KT Shetty Memorial Oration (2021)” by the Indian Academy of Neurosciences. He has recently been conferred with "Mrs. Abida Mahdi

Award–2022" by the Indian Academy of Biomedical Sciences for outstanding contributions to the field of neurosciences. He is also a Fellow of Indian Academy of Neurosciences and Indian Association of Biomedical Scientists. He has been listed among the World 2% Scientists for the year 2020 released now by the Stanford researchers from Panjab University.

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