Inflammation: the Common Link in Brain Pathologies

Nihar Jana · Anirban Basu
Prakash Narain Tandon
Editors

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Editors
Nihar Jana
Molecular and Cellular Neuroscience
National Brain Research Centre
Gurgaon, Delhi
India

Anirban Basu
Molecular and Cellular Neuroscience
National Brain Research Centre
Gurgaon, Delhi
India

Prakash Narain Tandon
National Brain Research Centre
Gurgaon, Delhi
India

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Preface

The role of neuroinflammation, as a common denominator of diverse neurological disorders including ageing, infections, trauma, stroke, demyelinating and degenerative diseases, was overlooked till recently since it lacked the classical markers of inflammation elsewhere in the body. It was only after the tools and techniques of molecular biology were utilized to investigate the pathophysiology of these conditions that the tell-tale evidence of inflammation in all these pathologies came to light. Not only inflammation was found to accompany these lesions but also it soon became evident that neuroinflammation plays a critical role in the pathogenesis of these conditions.

Over the years voluminous literature has accumulated on the subject but the knowledge is dispersed and not available as a comprehensive overview. It was realized that a number of neuroscientists in different parts of the country were studying various aspects of neuroinflammation in specific disease entities. This prompted us to bring together at one place the current knowledge on the subject (the proverbial nine blind men and the elephant!).

This monograph has 13 chapters contributed by investigators from institutions in different parts of the country. The first chapter is an overview providing a definition of neuroinflammation, its biomarkers and its cellular and molecular components. An attempt is made to answer a series of questions regarding its significance in different pathologies and a brief mention is made on the role played by ageing, obesity, metabolic disorders and systemic infection/inflammation. It outlines its clinical implications. Patro and his colleagues (Chap. 2) elaborate the role of microglia as the dominant player in initiating and promoting the inflammatory cascade, while in the Chap. 3 Tiwari and Seth discuss the role of astrocytes in the process. They specially highlight their role in pathogenesis of HIV-associated neurodegenerative disorders. Dutta, Ghosh and Basu, in Chap. 4, elaborate the dangerous liaison between infections and inflammation. They provide an account of the immune responses (which form the basis of inflammation), to different types of infections affecting the central nervous system. Chapter 5 by Singh and Das Sharma deals with role of neuroinflammation in demyelinating disease. Tripathi and Jana, in Chap. 6, present an overview of neuroinflammation related to neurodegenerative disorders, taking Huntington's disease as an example. This is followed by a chapter on neuroinflammation during Parkinson's disease by Sinha et al.,

amyotrophic lateral sclerosis (ALS) by Upadhyay et al., and by Alam et al., neuroinflammation in ischemic stroke. Irshad, Madan and Chosdol (Chap. 10) have dealt with role of inflammation in augmenting tumour progression, angiogenesis, promoting tumour cell proliferation and survival. Nivedita Chatterjee (Chap. 11) discusses the dysfunction of glia as a cause of many retinal disorders. Kaur et al. deals with, till recently unexpected, systemic disorder, obesity and its complementary role in augmenting neuroinflammation triggered by any aetiology. The possible therapeutic implications of the new knowledge have been referred to by all authors. The last chapter by Ghosh and Ghosh discusses the role of microglia in adult neurogenesis.

The editors take this opportunity to thank all authors and their collaborators to accede to their request to contribute to this book, which will hopefully be of great utility to students and researchers interested in neurosciences.

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Gurgaon, India

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About the Editors

Nihar Jana is presently working as Professor at National Brain Research Centre (NBRC), Manesar. Dr. Jana obtained his Ph.D. from Visva-Bharati University in 1996. After completing his post doctoral training at RIKEN Brain Science Institute, Japan, he joined NBRC in 2001. His laboratory is primarily interested in exploring the role of ubiquitin ligases in cellular protein quality control and how loss of function of quality control ubiquitin ligases leads to neuronal dysfunction or neurodegeneration observed in various neurological disorders. Dr. Jana is elected fellow of National Academy of Sciences, India (2008) and West Bengal Academy of Science and Technology (2012). He is a recipient of National Bioscience Award (2008, DBT) and TATA Innovation Fellowship (2014, DBT), VASVIK award (2012) and KT Shetty memorial award (2013 from Indian Academy of Neurosciences). Currently, he is serving as an editorial board member of PLoS ONE, Frontier of Molecular Neurosciences and Annals of Neurosciences.

Anirban Basu is a Senior Scientist and Additional Professor at National Brain Research Centre, Manesar, Haryana. He received his Ph.D. degree in Immunology from the Indian Institute of Chemical Biology, Kolkata. He then obtained post-doctoral training in neuro-immunology at Neural and Behavioral Science Department in Pennsylvania State University College of Medicine, US. So far he has trained 4 Masters students, 9 PhD students and 9 postdocs, and numerous short-term and long-term research trainees in his lab. Dr. Basu has long been interested in curing diseases of the nervous system. His current research is focused on identifying the role of microglia and neural stem/progenitor cells in the healthy and diseased central nervous system, with specific reference to CNS infections, and neurodegenerative diseases. The students currently working with him are testing strategies to develop disease modifying therapy by abrogating inflammation in CNS disorders. Dr Basu is the recipient of National Bioscience Award for Career Development (2010), Vasvik Industrial Research Award (2011), Dr. J.B. Srivastav Oration Award (2011), Rajib Goyal Prize (2012) and NASI- Reliance Industries Platinum Jubilee Award (2013), Tata Innovation Fellowship (2015) from the Department of Biotechnology, and Senior Scientist Oration Award (2015) from the Indian Immunology Society. He is also an elected Fellow of the National Academy of Sciences, India and West Bengal Academy of Science and Technology. Dr Basu sits on the editorial boards of the Journal of Neurochemistry, Scientific Reports,

Journal of Neuroinflammation, PLoS One, Frontiers in Molecular Neuroscience, and Metabolic Brain Diseases. He is also a faculty member in the Faculty of 1000 in the section Neurological Disorders.

Prakash Narain Tandon is a National Research Professor and President of National Brain Research Centre Society, Manesar. He has graduated with an MBBS and an MS from the University of Lucknow in 1950 and 1952, respectively. He was trained at the University of London and obtained his FRCS in 1956. He further obtained his specialist training in neurosurgery at Oslo, Norway and Montreal, Canada. After a brief tenure as Professor at the K.G. Medical College, Lucknow (1963–1965), he moved to the prestigious All India Institute of Medical Sciences, New Delhi where he founded the neurosurgery department and has been a Professor of Neurosurgery. He received Bhatnagar award (CSIR). He is an elected fellow of the National Academy of Medical Sciences and Indian National Science Academy. He also served as President of Indian National Science Academy in 1991–1992. He has been awarded Padma Shri (1973) and Padma Bhushan (1991) by the Government of India.