

Preface

Dysfunction of Glial Cells in Neurological and Psychological Disorders: From Bench to Bedside

There is growing evidence that glia is not only supporting neurons passively but also physiologically controlling development and plasticity of the nervous system [1]. It is well known that astrocytes, which are most abundant in the central nervous system (CNS), play important roles in neurovascular coupling to regulate blood flow to the active neurons and tripartite synapse formation consisting of presynaptic membrane, postsynaptic membrane and surrounding astrocyte to produce effective neurotransmission. On the other hand, microglial cells are the essential players in the pruning of unnecessary synapses during development.

In addition to the physiological roles, glial cell are deeply involved in pathological conditions such as neurodegenerative and demyelinating disorders in the CNS [2]. The main pathology of these diseases is called neuroinflammation, which is characterized by glial activation along with production of cytokines, radicals and their related substances. It is now known that neuroinflammation is also an essential pathology in other diseases than neurodegenerative/demyelinating diseases. For example, the chronic fatigue syndrome and its animal models show neuroinflammation causing severe fatigue [3, 4]. Furthermore it has been shown that neuroinflammation is also involved in some psychiatric diseases such as schizophrenia, depression and autism, which will be reviewed in this issue.

This special issue on glial cells introduces recent findings (1) that some species of glycerophospholipids can induce cellular signaling in glia to protect neuroinflammation, (2) that glial cells regulate the establishment of blood-brain barrier (BBB), barriergenesis, and angiogenesis in the brain development, (3) that psychiatric diseases such as schizophrenia, bipolar disorder, depression and autism involve

abnormalities in expression of some microglial markers, (4) that not only microglia but also astrocytes and oligodendrocytes show their dysfunctions in various psychiatric disorders. And neuronal and glial cells can be directly induced from skin fibroblast and blood cells of psychiatric patients to understand the pathology of the diseases, and (5) that nicotine has neuroprotective effect through its action on both astrocytes and microglial cells.

M.S. Hossain and T. Katafuchi reviewed anti-neuroinflammatory and anti-apoptotic actions of ether-linked glycerophospholipids, plasmalogens (PLs), to inhibit glial activation through the activation of protein kinases, Akt and ERK1/2. Interestingly PLs are shown to activate these kinases through some orphan G protein coupled receptors (GPCRs), suggesting that PLs can be ligands for those GPCRs. They also review the differential effects of other bioactive lipids in the brain on glial activation.

A.B. Salmina et al. discussed the importance of glial cells in the development of BBB, barriergenesis, and angiogenesis in terms of the relationship between BBB impairment and cognitive dysfunction, aberrant behavior and other neurological deficits. Furthermore, importance of hypoxia-inducible factor 1 (HIF-1), lactate and copper is also discussed. They concluded that astroglial and microglial control of angiogenesis and barriergenesis might be one of the key mechanisms contributing to brain development.

M. Sakai et al. reviewed abnormalities in expression microglial markers (HLA-DR, CD11b, IBA-1, CD68 and GLUT5) in psychiatric postmortem brain. They also discussed recent current of research on expression profiling of microglial molecules using positron emission tomography (PET) and omics-based gene expression analysis of psychiatric brains.

T.A. Kato et al. reviewed recent topics of glia-related pathophysiology of psychiatric disorders based on rodent and human postmortem and imaging studies. Furthermore, they introduced a novel technique to produce directly induced neuronal and glial cells from somatic cells such as skin fibroblasts and peripheral bloods by utilizing a gene-modification technique and/or chemical applications, proposing a novel translational study using the induced neuronal and glial cells in psychiatric patients.

M. Noda reviews the function of $\alpha 7$ nAChR in glial cells and how nicotine attenuates neuronal death induced by activated microglia. Though there were several mechanisms for nicotine-induced neuroprotection, she concluded that nicotine-induced inhibition of NADPH oxidase (NOX), consecutive acidosis, leading to an activation of H^+ channel in microglia might have an important therapeutic potential in neuroinflammatory diseases.

This special issue highlights some of the recent topics in glia research. We hope that this issue will help the glia researchers, who seem to be increasing

greatly in number, to inspire new idea and hypothesis and contribute to the development of the glial research.

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