

【Grant-in-Aid for Scientific Research(S)】

Biological Sciences (Medicine, dentistry, and pharmacy)



Title of Project : Comprehensive study of the disorders of neural networks in the central nervous system and the biological systems that regulate their restoration

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Research Area : Medicine, dentistry, and pharmacy

Keyword : Neural network, Neurological diseases

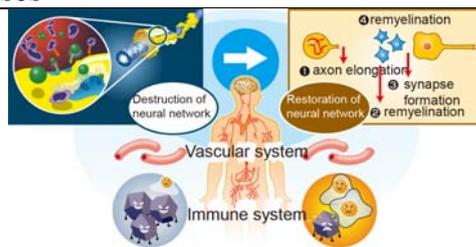
【Purpose and Background of the Research】

Disorders of the central nervous system, such as cerebrovascular diseases, cerebrospinal trauma, and encephalomyelitis, often cause spatiotemporal changes in the nervous system and in various biological systems, such as the immune system and vascular system. In this study, we analyzed disorders of the neural networks in the central nervous system and the subsequent restoration process from the perspective of the functional network of biological systems. Further, we analyzed the mechanism by which the spatiotemporal dynamics in those biological systems control a series of processes. Particularly, the ultimate goal of this study was to elucidate the control mechanism exerted by the associations among the nervous system, immune system, and vascular system.

Additionally, we aimed to elucidate the principles involved in the operation of living organisms with neural network disorders within the central nervous system by observing such disorders and their functional recovery process with respect to the dynamics of the entire biological system and by conducting a comprehensive analysis of the association between each system.

【Research Methods】

We will use unilateral cerebral cortical contusions, as well as in spinal cord injury and experimental autoimmune encephalomyelitis (EAE) in mice. We will use these disease models to analyze spatiotemporal changes in gene expression and dynamics of immune and vascular cell groups. In addition, we will determine how the cells in the immune system and vascular system exert control on disorders in neural networks and their recovery and will proceed through an analysis of the mechanisms involved in the phenomena therein. By using the resulting findings and by understanding the mechanisms behind the recovery of neural networks through activation of each cell group, we will elucidate the principles behind living organisms' reactions during the acute phase of a disorder and during the recovery phase.



【Expected Research Achievements and Scientific Significance】

We perceived the central nervous system as a single organ within a biological system; further, studies from the perspective of the involvement of the entire biological system in disorders and recovery of neural networks are scarce. By perceiving disorders in the neural networks and the biological reactions during the subsequent recovery process as a “scrap-and-build” strategy, we aimed to elucidate the mechanisms behind a series of reactions as well as their significance that may potentially create a new and never-seen-before trend in Life Sciences.

【Publications Relevant to the Project】

- Ueno, M., Fujita, Y., Tanaka, T., Nakamura, Y., Kikuta, J., Ishii, M. and **Yamashita, T.** (2013) Layer V cortical neurons require microglial support for survival during postnatal development. **Nature Neurosci.** 16, 543-551.
- Muramatsu, R., Takahashi, C., Miyake, S., Fujimura, H., Mochizuki, H. and **Yamashita, T.** (2012) Neovessels formed through CNS inflammation promote neural rewiring. **Nature Medicine** 18, 1658-1664.

【Term of Project】 FY2013-2017

【Budget Allocation】 156, 000 Thousand Yen

【Homepage Address and Other Contact Information】

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