Activity-dependent mechanisms regulating dendritic morphology and function

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【Outline of survey】

A fundamental question is how an ensemble behavior of 100 billion neurons can possibly give rise to a coherent and integrated "brain" that controls the whole human organism. Our central nervous system is physically wired and organized based on evolutionary and developmental principles that are primarily encoded into the genome and that are highly conserved in mammals from rodents to primates. This neural network, however, is also able to recognize and memorize external and internal events as they occur, and flexibly act based on memories of experienced events. We aim to address the basic signal transduction mechanisms which mediate the interaction between electrical and chemical signaling in the dendritic compartments and which allows information to be written and re-written into the neuronal circuits.

Specifically, we will examine: 1) the mechanisms underlying the formation and maturation of the dendritic morphology; and 2) the mechanisms by which local synaptic events can induce neuron-wide global changes via activation of transcriptional, translational and cytoskeletal processes; 3) the mechanisms that instruct individual synapses to alter or to maintain its responsiveness upon establishment of a global neuron-wide change in input-output function.

【Expected results】

Through this research project, we expect to better understand the precise nature and the whole spectrum of the molecular changes, both local and global, in the neurons undergoing profound modifications of the synaptic wiring, during development and in adult animals. Furthermore, we will identify key molecular and cellular mechanisms and principles that govern information processing and storage in active neuronal circuits.

【References by the principal investigator】

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- Ohmae S, Takemoto-Kimura S, Okamura M, Adachi-Morishima A, Nonaka M, Fuse T, Kida S, Tanji M, Furuyashiki T, Arakawa Y, Narumiya S, Okuno H, Bito H. Molecular identification and characterization of a family of kinases with homology to Ca^{2+}/calmodulin-dependent protein kinases I/IV. *J. Biol. Chem.* 281: 20427-20439, 2006.

【Term of project】 FY2008－2012	【Budget allocation】 80,600,000 yen (direct cost)

【Homepage address】 http://www.neurochem.m.u-tokyo.ac.jp/Homepage.html