ABSTRACT

Workshops

WS2D-1-1 The use of photoactivated adenylyl cyclase (PAC) for the study of neuronal morphogenesis

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Proper neuronal morphogenesis is fundamental to the establishment of functional neural circuits. Cyclic adenosine monophosphate (cAMP) has been identified as a key regulator of cellular events among a variety of neurons. Especially, cAMP plays an important role in regulating axonal outgrowth: however, it remains unclear whether and how cAMP regulates axonal branching and elongation independently, because of a lack of techniques that enables spatiotemporal modulation of the intracellular cAMP levels. Here we utilized photoactivated adenylyl cyclase (PAC), which is originally isolated from *Euglena gracilis* and produces cAMP either transiently or continuously depending on the exposure time to the blue light. In this talk, we will introduce our application of PAC for the study of axonal morphogenesis, showing that axonal branching and elongation are independently regulated by different signaling pathways.

WS2D-1-2 Molecular mechanism of neurovascular coupling in pathological central nervous system (CNS)

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Vascular remodelling is a prominent anatomical feature of CNS disease including multiple sclerosis, stroke, epilepsy, amyotrophic lateral sclerosis, and brain tumour. During development, formation and maturation of vascular network are affected by the factors from neuronal cells. Therefore, we hypothesized that vascular remodelling in pathological CNS may be regulated by neuronal network. In this study, we investigated the role of neuronal change in CNS angiogenesis in the experimental autoimmune encephalomyelitis, an animal model of multiple sclerosis. We used biochemical technique for unveil the key molecule from neuronal cells which activates vascular remodelling. We succeeded the identification of molecule from neuron that promotes vascular endothelial cell proliferation. In this presentation, we will talk our recent data and speculation in involvement of neuronal change in vascular remodelling in CNS disease.

WS2D-1-3 Fiber optic calcium recording in the ventral striatum in freely moving mice

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The recording of cell-type specific activity is essential to understand the mutual relationship between the brain activity and behavior in animals. The *in vivo* calcium imaging by a microscopy has been most widely used for this purpose. However, the application is confined to superficial brain structures in mice because of the limitation of working distance of microscopy. In addition, the brain imaging by a conventional microscopy requires head-restraint. To pursue the recording from deep brain structure in freely moving mice, we developed a fiber optical recording system to measure the intracellular calcium levels in a cell-type specific manner. We exploited genetically encoded calcium indicator expressing transgenic animals, in which ratiometric probe, Yellow Cameleon-Nano 50, were expressed by the striatopallidal neurons in the basal ganglia. The system detected cyan and yellow fluorescence from a columnar zone with 0.4 mm diameter and 0.7 mm depth, and calculated the ratio of these signals as an intracellular calcium level. We succeeded in observing distinct patterns of compound calcium transients in the ventral striatum, especially a disappearance of fluctuation during the aversive situation and a surge after the release from aversion.

WS2D-1-4 Combined techniques of large-scale electrophysiological recordings and optogenetics for studying inter-regional neuronal interactions

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Studying the physiological mechanisms of cognitive functions requires understandings not only the responses of single neurons to external stimuli but also circuit computations at the level of networks of neurons during cognitive processing. To understand the 'syntax' underlying neuronal communications, methods for monitoring and quantifying cooperative neuronal activities during cognition are required. To this end, we have been performing large-scale high-density recordings of local circuits with multi-channel silicon probes, enabling the observation of simultaneous neuronal firing activities in up to 100 neurons, as well as local field potentials in behaving animals. In addition, we are developing a new technique that combines large-scale recording and targeted simultaneous optogenetic stimulations of specific cells to clarify the role of the different types of neurons. These techniques are useful for investigating circuit computations within local and between the inter-regional networks during cognitive behaviors.