別紙２

Results report

１．Title of Research and Development：The development of the functional organization in visual cortex

２．Principal Investigator：

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４．Results of Research and Development:

The functional organization of the visual cortex describes the layout of tuning properties in large numbers of individual neurons. How it develops from synaptic connectivity is a central question of neuroscience. Recent studies in mice suggest that significant changes in the functional organization occur after eye opening. Moreover, recent technological advancements provide the unique opportunity to monitor these changes simultaneously in large numbers of cells. In this proposal we will perform two-photon calcium imaging of large populations of neurons in the developing mouse visual cortex to study how the functional organization changes during normal development. As a complementary effort, we will develop a computational circuit model, to understand which properties of the cortical network and of its feed-forward inputs account for the observed changes. To directly measure how visual response properties in individual neurons reorganize during development, we will make chronic two-photon recordings in mice around the time of eye opening. We study the network model over time, aiming to identify candidate mechanisms of cortical reorganization from a quantitative comparison between model and experiment. The proposed research will significantly broaden our understanding of the factors guiding the formation and maturation of the functional organization of the visual cortex.

This year, the Japan team developed a wide-field calcium imaging method using macro-zoom microscope, and found that patterns of spontaneous activity in the mouse cerebral cortex change dramatically during normal development. Furthermore, they developed a method for chronic two-photon calcium imaging and chronically observed changes of response selectivity of neurons in mouse visual cortex. The German team received the data of spontaneous activity in the mouse cerebral cortex during development and started the analysis of the data.