論文の内容の要旨

論文題目　Encoding of behavioral variables by complex spikes in clusters of cerebellar Purkinje cells during voluntary movement（随意運動中の小脳プルキンエ細胞集団における複雑スパイクによる行動変数の符号化について）

氏名　日髙　直樹

The activities of cerebellar neurons represent sensorimotor variables as well as non-motor variables, such as reward signals. In particular, climbing fibers have been shown to convey a variety of information, including sensory and movement variables, reward-related signals, and decision errors, in addition to the classical error signals for motor control and learning. However, how such diverse information is spatiotemporally organized in the activity of climbing fibers remains unclear. What and to what extent do individual climbing fibers encode during behavior? Is each behavioral variable encoded in a specific subset of climbing fibers? How are different variables distributed over the cerebellar cortex? To address these questions, I performed two-photon calcium imaging from the cerebellar Purkinje cells in mice during a self-initiated forelimb lever-pull task. I found several sets of Purkinje cells in lobule V of the cerebellar vermis, which responded before and after the lever-pull onset. These responses in each Purkinje cell, which are used as the proxy of climbing fiber responses, were found to be explained by the combination of several behavioral variables such as lever-pull/release, licking, and trial outcome. Neighboring Purkinje cells exhibited similar response patterns, indicating that functionally equivalent climbing fibers are spatiotemporally clustered. Furthermore, I found several sharp boundaries of adjacent clusters that show very different response characteristics. Together, individual climbing fibers multiplex several behavioral variables and are topographically organized to form functional clusters, which are fundamental to the modular architecture of the cerebellar cortex.