**OIST Seminar**

Date: Tuesday, Jan 23, 2023

Time: 10:00 – 11:00

Location: Seminar Room L4E01

Speaker:

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Title: Elucidating the structure of prefrontal cortical network transformation underlying flexible task-switching

Abstract:

In constantly changing environments, animals must adapt their behaviors based on informative sensory stimuli. Because the meaning of a given sensory input can vary depending on the situation, the brain must flexibly map each stimulus to its appropriate output depending on internal goals. The prefrontal cortex (PFC) is known to be key area for the implementation of such flexible transformations, but due to the complexity of PFC representations, it remains unclear whether the specific network structures of the PFC are required to support such adaptive information processing. We approached this problem by identifying decoder neurons which act as fixed nodes of PFC network and examined how the PFC network reconfigures when the decoder neurons change with the task-switching. I previously demonstrated that in the rule-dependent sensory selection task, PFC neurons projecting to different territories of the tail of striatum acted as decoders, providing outputs that control the relative gain of meaningful and distracting inputs. These outputs were anatomically fixed, placing a fundamental constraint on the internal dynamics of the PFC. These findings led to the discovery that the requirements of specific outputs (PFC to auditory part of the striatum) to the network changed depending on the task requirements. Leveraging this task-dependent recruitment of specific output neurons, we have implemented new task-switching paradigms to examine how the PFC network adaptively reconfigures to engage appropriate “decoder” neurons. By recording and optogenetically manipulating neural activity in the PFC and the striatum of task-performing mice, we identified specific changes of inhibitory/excitatory effective connectivity on the decoder neurons, depending on which task-switching was performed. Overall, our study shows the dynamic reconfiguration of PFC task networks are not generated randomly but rather that they are structured to flexibly recruit proper decoder neurons without interference across multiple tasks.