Goal9 Realization of a mentally healthy and dynamic society by increasing peace of mind and vitality by 2050.

Maximizing well-being and agency on the basis of interpersonal comparison of brain indicators

Here begins our new MIRAI

MOONSHOT
RESEARCH & DEVELOPMENT PROGRAM

R&D item

5. Comprehensive understanding of subjective reward value representation in rodent brain for interindividual comparison

Progress until FY2023

1. Outline of the project

We are measuring brain activity using widefield microscopes and high-density electrodes. This helps us understand what rewards and desires the animals are experiencing. Additionally, we are developing behavioral tasks that may contribute to understanding decision-making.
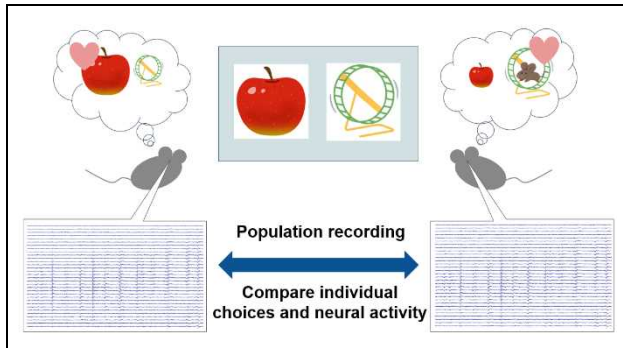
2. Outcome so far

(1) We conducted a study on reward value using classical conditioning. Rats were trained to associate a sound cue with the availability of water, leading to anticipatory licking behavior. Next, we introduced fluorescent protein sensitive to specific substances using viral vectors. Some brain regions showed responses to rewards under a wide-field microscope. Neurons in these regions showed similar responses when their activity was examined using high-density electrodes. Through combined analysis on the same animals, we gained deeper insights into how the brain responds to rewards. Further detailed analysis of these findings is planned.
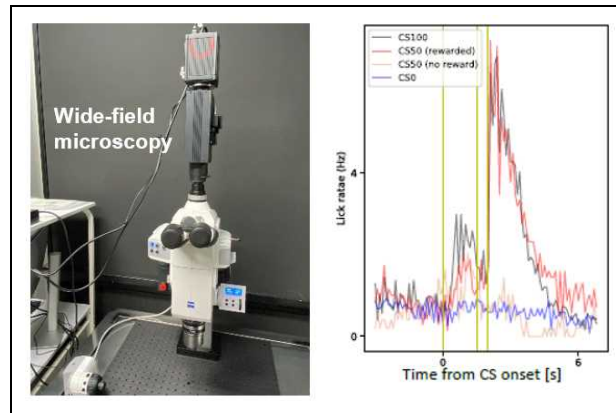
(2) To understand desire mechanisms akin to human research, we established behavioral tasks in animal models. Last year, we initiated a simple task where animals received a reward upon pressing a button, concurrently analyzing neural activity in the medial prefrontal cortex. In 2023, we integrated with video-based behavioral analysis. As a multiple choices task, we refined our training methods for quicker learning. These advancements enable us to develop more intricate tasks resembling human studies. Through these tasks, we explore neural activity changes during relearning and its association with rewards and desires.
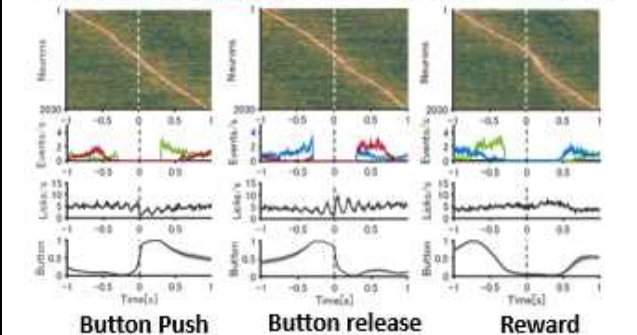
3. Future plans

We aim to measure and investigate the neural representation of subjective value of rewards in the rat brain at high density and resolution. We will administer manipulations to alter the value of rewards across individuals and observe differences in brain activity in response to these alterations. Additionally, we will develop tasks that aid in furthering our understanding of desire. Furthermore, we will engage in theoretical investigations to compare neural representations of value across individuals.
(TANAKA Yasuhiro: Tamagawa University)