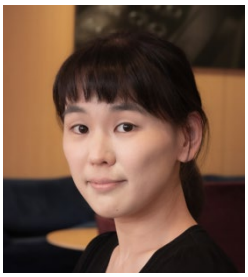

Neural Circuit of Multisensory Integration RIKEN Hakubi Research Team
RIKEN Hakubi Team Leader: Asuka Takeishi (Ph.D.)

(0) Research fields

CPR Subcommittee: Biology

Keywords: Neural Circuit, Behavioral analysis, Chemotaxis, Thermotaxis, In vivo calcium imaging

(1) Long-term goal of laboratory and research background

We are interested in how animals make behavioral decisions. Animals are exposed to continuously changing environmental stimuli, such as temperature, odor, light and sound. We sense and integrate these environmental cues in the nervous system in order to choose appropriate behavioral responses. We are currently investigating the mechanism of multi-sensory integration in the nervous system by analyzing behavior strategies and neural circuits of C. elegans that are exposed to multiple stimuli, especially temperature and odor. In addition to this biological approach, we incorporate mathematical and computational models to reveal the evolutionally-conserved fundamental mechanism of behavioral decision.

(2) Current research activities (FY2019) and plan (until Mar. 2025)

Our laboratory started in 2019 July. After construction of the laboratory completed in 2020 Jan, we started culturing *C. elegans* and chemotaxis experiments using various odors (Figure 1). We also designed rigs for thermotaxis experiments, and set up a microscope for calcium imaging with free-moving worms. We are planning to conduct following experiments in FY2020 and later.

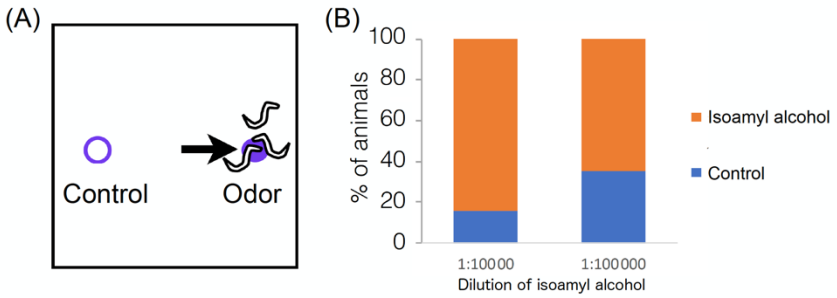

Figure 1 Chemotaxis of *C. elegans*
(A) Worms migrate toward their favorite odor when they are placed at the middle of the plate.
(B) Result of Chemotaxis assay with diluted isoamyl alcohol.

1. Behavior analysis of worms exposed to multiple stimuli (FY2020-)

We will place worms on the plate with temperature gradient and expose them to odorant to examine their behavior. We are particularly interested in their behavior choice in the condition that directions of their preferable temperature and odor are opposite. We'll modify gradient of the temperature and concentration of odor to optimize experimental condition for the experiments below.

2. Behavior analysis using auto-tracking system (FY2020-)

We'll use auto-tracking stage for *C. elegans* (Figure2). We first need to optimize tracking condition to make it possible to track worms for long time. We will then conduct behavior analysis of worms using temperature/odor condition obtained in 1 to reveal their detailed behavior strategy during their migration toward their desired direction.

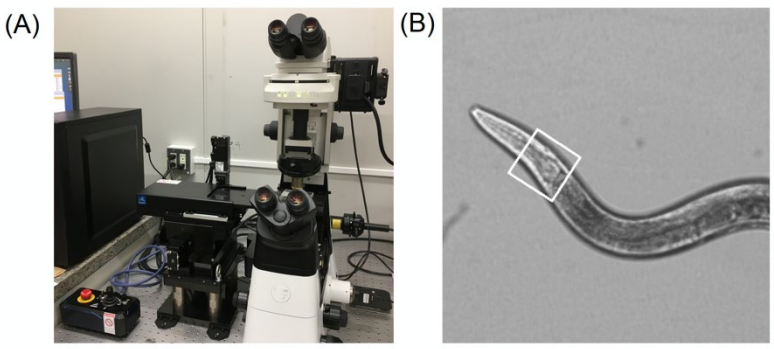

Figure 2 Auto-tracking system for *C. elegans*
(A) Microscope with stage for auto-tracking of *C. elegans*
(B) Stage is regulated automatically to chase the region of interest

3. Calcium imaging in nervous system (FY2021-)

We'll analyze activity of each neuron of free-moving worms by calcium imaging using the experimental condition 2 in order to reveal "which neurons" plays "what roles" for behavior choice. Calcium imaging can be performed on either single or multiple neurons at same time.

4. Identify the molecules that contribute to behavior choice (FY2020 -)
We'll identify the molecules that plays important roles during behavior choice by screening of behavior assay using forward-genetics techniques and/or calcium imaging on mutants of candidate genes.

(3) Members as of March, 2020

(RIKEN Hakubi Team Leader)
Asuka Takeishi

(4) Representative research achievements

1."Neural Communication that Mediates Starvation-dependent Thermotaxis Plasticity in *C. elegans*", Asuka Takeishi, NSI workshop 2019, 2019, 11, 12-13
2. "線虫を用いた行動決定メカニズムの解明", Asuka Takeishi, 第12回 CBIR/ONSA/大学院セミナー共催　若手インスパイアシンポジウム, 2020, 2, 12

Laboratory Homepage
https://www.riken.jp/en/research/labs/hakubi/t_neurcrt_multisens/index.html
https://cbs.riken.jp/en/faculty/a.takeishi/