

論文の内容の要旨

Function and formation of neuronal circuits

that regulate divergent action selection

(多様な行動選択を制御する神経回路の機能と形成)

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Animals process sensory inputs from the environment to produce adaptive motor outputs. Importantly, due to the size and nature of animal bodies, animals must discriminate the geometric position of the sensory input on the body. The mechanism of neuronal circuits that realizes such somatotopically-organized action selection has largely remained elusive.

In the current dissertation, I studied the function and formation of tactile-induced action selection circuitry using *Drosophila melanogaster* larvae, which escape by backward locomotion when touched on the head, while they crawl forward when touched on the tail.

First, I identify a class of segmentally repeated second-order somatosensory interneurons, that I named Wave, whose activation in anterior and posterior segments elicits backward and forward locomotion, respectively. Anterior and posterior Wave neurons extend

their dendrites in opposite directions to receive somatosensory inputs from the head and tail, respectively. Downstream of the anterior Wave neurons, I identify premotor circuits, which together with Wave, are necessary for the backward locomotion touch response.

Next, I show the developmental process of the formation of Wave neuron morphology. Stage-by-stage observation suggested that Wave neurons are identical to a class of known pioneer neurons. I show the recruitment of Wnt/Fz signaling in guiding axons of posterior Wave neurons onto more posterior neuromeres. Furthermore, cell-specific knock-down of DFz4 partially inhibited the commandability of fictive forward locomotion but not of backward locomotion.

Taking these together, I propose that segment-specific neurite extension of Wave neurons mediates divergent action selection. As these neurons are likely to be conserved across species, the present study may serve as a model to study the general principle of action selection circuits.