論文の内容の要旨

Analyses of neural population dynamics generating distinct behaviors of *Drosophila* larvae

（ショウジョウバエ幼虫の様々な行動を生成する神経細胞集団活動ダイナミクスの解析）

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The way in which the central nervous system (CNS) governs animal movement is complex and almost impossible to solve solely from the movement pattern. We tackle this problem by observing the activity pattern of a large population of neurons in the CNS in Drosophila. *Drosophila* larvae show various behaviors, including forward locomotion, backward locomotion, and turning. We focused on these three behaviors and analyzed the neural activity of the larval CNS corresponding to these behaviors.

We recorded calcium imaging movie of isolated *Drosophila* larval CNS undergoing fictive locomotion using light-sheet microscopy which allows acquisition of neural activities in a large volume at a fast frame rate. After recording the movies, we executed preprocessing to eliminate artifacts. Since the size of the data was large and contained a lot of information, we compressed the data in an automated manner.

We then analyzed the neural activity of the CNS at a circuit level. The principal component analysis showed the circuit generates at least two distinct activity patterns. Also, by applying hidden Markov model to the activity of neural population, more detailed classification of the activity pattern was made. Using information of the circuit state at each time, we found neurons which exhibit circuit state-specific activity. Also, we found neurons in the anterior CNS, which were active at the beginning of the fictive forward locomotion and thus were good candidates for triggers of forward locomotion.