博士論文(要約)

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(ショウジョウバエ幼虫の後退運動において体節間で協調した筋弛緩を制御する介在神経細胞の同定と機能解析)

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刊行を予定しているため、博士論文の5頁から最終頁は除外する。

Typical patterned locomotion in animals is achieved through combinations of contraction and delayed relaxation of multiple muscles. Specifically, it is known that muscular relaxation is an important factor for speed regulation of locomotion. However, the neural basis of how intersegmentally coordinated patterns of delayed muscular relaxation are generated remains poorly understood. I used *Drosophila* larval backward locomotion as a model to address this question. Larval backward locomotion, an escape behavior against exposure to blue light or a noxious stimulus to the anterior body segments, occurs as a propagation of muscular contraction and delayed relaxation from anterior to posterior. The pattern of contraction and delayed relaxation of muscles is in turn achieved by activation and delayed inactivation of motor neurons innervating each muscle. Here, I identified an intersegmental pattern generator that is specialized for muscular relaxation in larval backward locomotion. I also identified a novel class of cholinergic ascending interneurons located in each neuromere, and named them Canon neurons. I used calcium imaging of the isolated central nervous system and found that Canon neurons show wave-like activity during fictive backward locomotion. Optogenetic activation of Canon neurons induced relaxation of body wall muscles, whereas genetic inhibition prolonged muscular contraction. Canon neurons received synaptic inputs from command neurons of larval backward locomotion and sent outputs to inhibitory premotor neurons. Furthermore, Canon neurons in different neuromeres form synapses with each other. When synaptic transmission between Canon neurons was disrupted by the expression of TeTxLC, the propagating activity of Canon neurons was disrupted, suggesting that Canon neurons regulate their own patterned activities intersegmentally. Taken together, these results suggest that the Canon networks constitute an intersegmental pattern generator that generates motor inactivation in each neuromere in backward locomotion. Thus, this study revealed the presence of a late-phase central pattern generator that works independently of earlier-phase excitatory pattern generators for muscular contraction, and regulates muscular relaxation.