PIBB 生物化学与生物物理进展
Progress in Biochemistry and Biophysics
2023, 50(6): 1243
www.pibb.ac.cn

A New Insight Into Inhibitory Regulation of Motor Behavior Brought by Acetylcholine-gated Chloride Channel Receptors

Acetylcholine, the first identified neurotransmitter, plays crucial roles in various brain functions. One well-known case is its involvement as an activating neurotransmitter in the regulation of locomotion. However, its inhibitory regulatory role, particularly in locomotion, remains poorly understood. In a study conducted by Polat *et al*. (Prog Biochem Biophys, 2023, **50**(6): 1381-1390. DOI: 10.16476/j. pibb. 2023.0146), the authors investigated the inhibitory role of acetylcholine in locomotion in *C. elegans*. In this organism, the acetylcholine-gated chloride channel receptor consists of four subunits. The authors thoroughly examined the loss-of-function of each subunit in movement regulation. Interestingly, the mutant worms were still capable of performing various movements such as forward, backward crawling, and turning, suggesting that the overall movement was not significantly affected. However, quantitative behavior analysis revealed subtle yet significant differences in the timing and postures of the movement in these mutants. Furthermore, the authors employed optogenetics to stimulate a specific neuron involved in backward crawling and demonstrated that the loss-of-function of the receptors in individual neurons affects the transitioning between locomotion modes.

This work provides evidence for the inhibitory regulatory role of acetylcholine in locomotion. The loss-of-function of acetylcholine-gated chloride channel receptors likely disrupts the balance of neuronal and circuit physiology, thereby affecting the regulation of locomotion. Moreover, this study highlights the powerful role of quantitative behavior analysis in discovering and understanding more sophisticated functions of neural circuits.

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DOI: 10.16476/j.pibb.2023.0226
Received: June 7, 2023 Accepted: June 9, 2023