Journal of Neuroscience Methods

Volume 191, Issue 1, 15 August 2010, Pages 90-93

Short communication

High-throughput study of synaptic transmission at the neuromuscular junction enabled by optogenetics and microfluidics

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https://doi.org/10.1016/j.jneumeth.2010.05.019

Abstract

Over the past several years, optogenetic techniques have become widely used to help elucidate a variety of neuroscience problems. The unique optical control of neurons within a variety of organisms provided by optogenetics allows researchers to probe neural circuits and investigate neuronal function in a highly specific and controllable fashion. Recently, optogenetic techniques have been introduced to investigate synaptic transmission in the nematode *Caenorhabditis elegans*. For synaptic transmission studies, although quantitative, this technique is manual and very low-throughput. As it is, it is difficult to apply this technique to genetic studies. In this paper, we enhance this new tool by combining it with microfluidics technology and computer automation. This

new tool by combining it with microfluidics technology and computer automation. This allows us to increase the assay throughput by several orders of magnitude as compared to the current standard approach, as well as improving standardization and consistency in data gathering. We also demonstrate the ability to infuse drugs to worms during optogenetic experiments using microfluidics. Together, these technologies will enable high-throughput genetic studies such as those of synaptic function.

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Keywords

Microfluidics; Optogenetics; *C. elegans*; Synaptic function; Channelrhodopsin

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