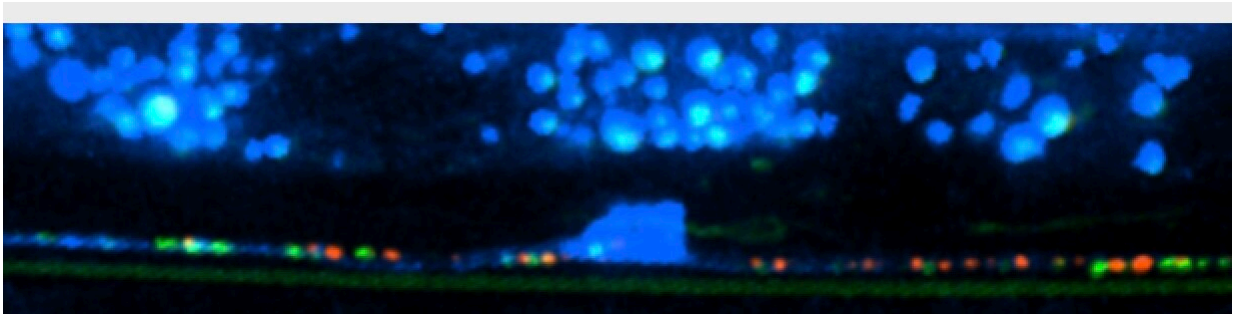


# How synapses are built and function in the nervous system

November 8 2021

---



Multicolored electrical synapses in a *C. elegans* motor neuron. Credit: Sierra Palumbos

Nerve cells in the brain establish connections or synapses to form complex electrical circuits that keep people thinking and moving. Despite the importance of these synapses in mediating the flow of charged particles between neurons, not much is understood about how these connections are created.

Research conducted by graduate student Sierra Palumbos and Professor of Cell and Developmental Biology David Miller sought to identify the underlying genetic mechanisms that specify the location of the brain's electrical synapses.

Using the nematode *C. elegans* as a model, the researchers developed

new methods to measure function of active electrical synapses called gap junctions, and they deployed live cell imaging techniques—developed in Miller's lab—to visualize them. This is the first time that these techniques have been used in the intact nervous system of a living organism.

"We have identified a signaling pathway that directs the formation of electrical synapses between specific neurons," Palumbos said. A key component of this pathway, cyclic AMP or cAMP, drives the movement of gap junction components to specific destinations in each neuron for assembly into electrical synapses.

*C. elegans* is especially useful for these studies because its nervous system has only 302 neurons, compared with the human brain's 100 billion. Also, human and *C. elegans* nervous systems are guided by similar genetic rules. Thus, research conducted in *C. elegans* offers an indirect but powerful strategy for illuminating the genetic instructions that build the human brain. Because cAMP is also found in human [neurons](#), this work in *C. elegans* predicts that cAMP directs assembly of electrical synapses in the brain, a phenomenon that can be altered by stroke or neurodegenerative disease.

Electrical synapses are composed of modular components that are routed to specific destinations in each neuron in the brain for assembly. The next step is to identify the molecular "motor" that transports these components and to establish how cAMP controls its trafficking activity, Miller said.

**More information:** Sierra D. Palumbos et al, cAMP controls a trafficking mechanism that maintains the neuron specificity and subcellular placement of electrical synapses, *Developmental Cell* (2021). [DOI: 10.1016/j.devcel.2021.10.011](https://doi.org/10.1016/j.devcel.2021.10.011)

Provided by Vanderbilt University

Citation: How synapses are built and function in the nervous system (2021, November 8)  
retrieved 27 June 2024 from <https://medicalxpress.com/news/2021-11-synapses-built-function-nervous.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.