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A magnetic trick for treating neurological disorders

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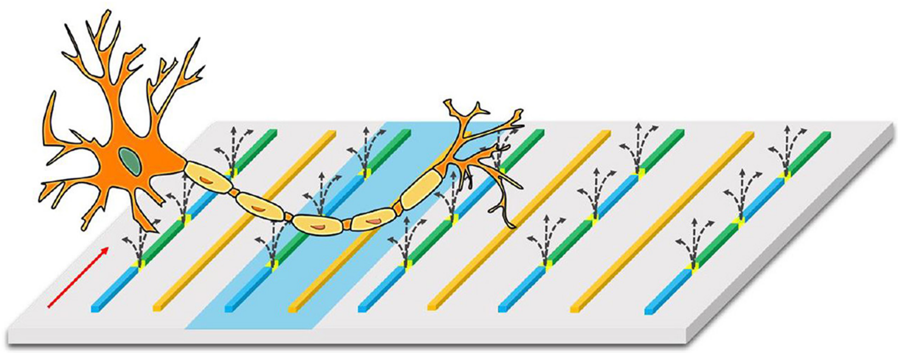
An implantable nanodevice may be the solution to current neuron stimulation techniques, which have limited range and require inconvenient, high-power equipment.



Neurostimulation therapy plays a crucial role in the prevention, diagnosis and treatment of brain disorders, but most methods require bulky, inefficient equipment and can only reach neurons near the surface of the brain. To address these shortcomings, Su et al. propose an implantable magnetic nanodevice that provides highly localized stimulation signals to specific neurons – even ones deep inside the brain.

Due to its small size, the proposed device can be surgically implanted within the brain near the targeted neurons. It consists of an array of magnetic nanostructures, each activated and controlled by a separate electrode. A spin-polarized current is applied to individual electrodes to induce a magnetic field, stimulating the targeted neurons and causing them to fire. Because magnetic signals are less affected by surrounding cells compared to electric signals, the nanodevice can provide neuron stimulation with higher resolution and accuracy than traditional neurostimulation methods at lower energy costs.

Depending on the clinical needs, the magnitude and duration of stimulation signal can be adjusted by changing the applied current, the material used and the geometry of the structure.

“The design of the nanostructures needs to be optimized to modulate the stimulation frequency and amplitude according to different types of neurons,” said author Diqing Su.

Similar nanostructures have already been fabricated for other types of applications, and theoretical results have so far supported the feasibility of stimulating individual neurons with such devices. However, a few issues, such as the toxicity of the materials, must be addressed before testing these applications on an actual brain.

Source: “Tunable magnetic domain walls for therapeutic neuromodulation at cellular level: Stimulating neurons through magnetic domain walls,” by Diqing Su, Kai Wu, Renata Saha, and Jian-Ping Wang, *Journal of Applied Physics* (2019). The article can be accessed at https://doi.org/10.1063/1.5122753.