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Startup Makes 'Wireless Router for the Brain'

Kendall Research's devices could make optogenetics research much more practical.
By Courtney Humphries

Optogenetics has been hailed as a breakthrough in biomedical science—it promises to use light to precisely control cells in the brain to manipulate behavior, model disease processes, or even someday to deliver treatments.

But so far, optogenetic studies have been hampered by physical constraints. The technology requires expensive, bulky lasers for light sources, and a fiber-optic cable attached to an animal—an encumbrance that makes it difficult to study how manipulating cells affects an animal's normal behavior.

Now **Kendall Research**, a startup in Cambridge, Massachusetts, is trying to free optogenetics from these burdens. It has developed several prototype devices that are small and light and powered wirelessly. The devices would allow mice and other small animals to move freely. The company is also developing systems to control experiments automatically and remotely, making it possible to use the technique for high-throughput studies.

Christian Wentz, the company's founder, began the work while a student in **Ed Boyden's lab** at MIT. He was studying ways to make optogenetics more useful for research on how the brain affects behavior. Optogenetics relies on genetically altering certain cells to make them responsive to light, and then selectively stimulating them with a laser to either turn the cells on or off. Instead of a laser light source, Kendall Research uses creatively packaged LEDs and laser diodes, which are incorporated into a small head-borne device that plugs into an implant in the animal's brain.

The device, which weighs only three grams, is powered wirelessly by supercapacitors stationed below the animal's cage or testing area. Such supercapacitors are ideal for applications that need occasional bursts of power rather than a continuous source. The setup also includes a wirelessly connected controller that plugs into a computer through a USB. "It's essentially a wireless router for the brain," says Wentz.

The wireless capabilities allow researchers to control the optogenetics equipment remotely, or even schedule experiments in advance.

Casey Halpern, a neurosurgeon at the University of Pennsylvania and one of several researchers beta-testing the device, says the physical impediments of current optogenetics techniques are tremendous. "You almost can't do any behavioral experiment in a meaningful way," he says.

Halpern, for instance, studies feeding behavior, and would like to understand how activating or inhibiting specific groups of neurons change the way mice eat. The ability to test that question right in the animal's cage without a human in the room makes it more likely the animal will behave normally.

Wentz says that while the cost of the initial setup is comparable to a single laser system, it can be scaled up far more cheaply. This, coupled with the ability to remotely control experiments, would make it easier to conduct optogenetics experiments in a high-

throughput fashion.

Kendall Research plans to make it possible to collect data from the brain through the device. The data could then be wirelessly transmitted to a computer. Sanjay Magavi, a research scientist at [Vertex Pharmaceuticals](#), says while "it isn't yet clear how this will be used in industry," there's increasing interest in using optogenetics in animals to develop more sophisticated models of disease for preclinical drug testing.

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