NEUROSCIENCE

Neuronlike electronics integrate with brain tissue without causing damage

Devices stably measure neuronal signals in mice for at least 90 days

by ***Celia Henry Arnaud***

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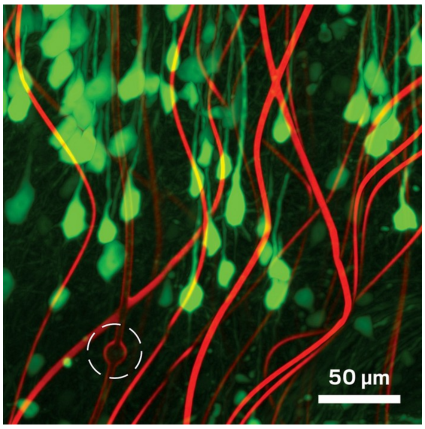
Researchers at Harvard University wanted to record the activity of individual neurons in mice without damaging surrounding tissue. The problem is the flexibility and size of electrodes often used for such measurements do not match that of the neurons they're recording. This mismatch can trigger an immune response within the tissue, damaging it. To avoid that damage, grad student Xiao Yang, chemistry professor Charles M. Lieber, and coworkers designed a probe that mimics the structure and mechanics of neurons (*Nat. Mater.* 2019, **DOI: 10.1038/s41563-019-0292-9**).



Credit: ***Nat. Mater.***

Neuronlike electronics (red) match the size and flexibility of neurons (green). An electrode is circled in white.

Lieber's group had previously made **mesh probes** with similar stiffness as brain tissue. Those probes were similar in size to the cell body of the neurons but larger than all other cell structures, such as axons, the long, wirelike parts that transmit electrical signals.

Yang made the new probes with platinum electrodes that are about the same size as the cell body of neurons. She connected the electrodes with polymer-encased wires that have about the same size and flexibility as axons, about less than one-tenth the size of the best previous flexible probes. A single device has 16 sets of these electrodes and wires.

The researchers **injected them into the hippocampi** of mice and measured electrical signals associated with neuronal activity. The probes easily integrated in the brain tissue without causing damage or evoking an immune response.

The signals from the 16 channels remained relatively stable over 3 months of recording. The researchers also observed new signals, which they attributed to the growth of new neurons from migrating neural progenitor cells.

Lieber wants to functionalize the probes to control the brain environment. "We have something that is basically matched to the cells you're trying to measure," Lieber says. "Now you can ask whether you can not only record what's going on but also manipulate that environment with biochemical signals."

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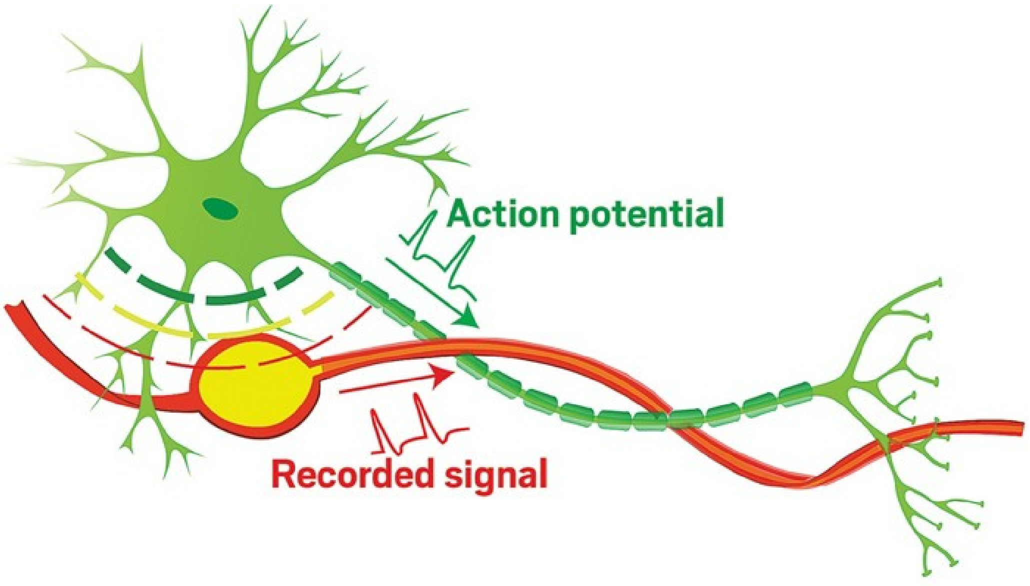

Credit: *Nat. Mater.*

The neuronlike electronics (red and yellow) are of similar size and structure as neurons (green).

Tal Dvir, who develops tissue-electronics interfaces at Tel Aviv University, says, "While the type of material is not new, it does represent a step forward in terms of the ability to integrate electrodes in the brain without eliciting an immune response and being able to monitor both the function of neurons and the migration of neurons."

In the long term, such interfaces might be used for controlling artificial limbs or for enhancing brain function. But in the short term, Lieber's team is collaborating with others to use the probes to study cognitive neuroscience and neurological diseases such as stroke.

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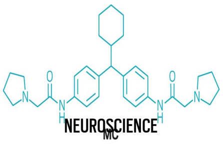

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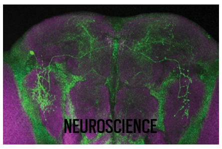

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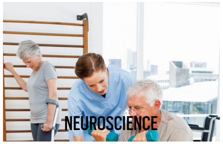

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