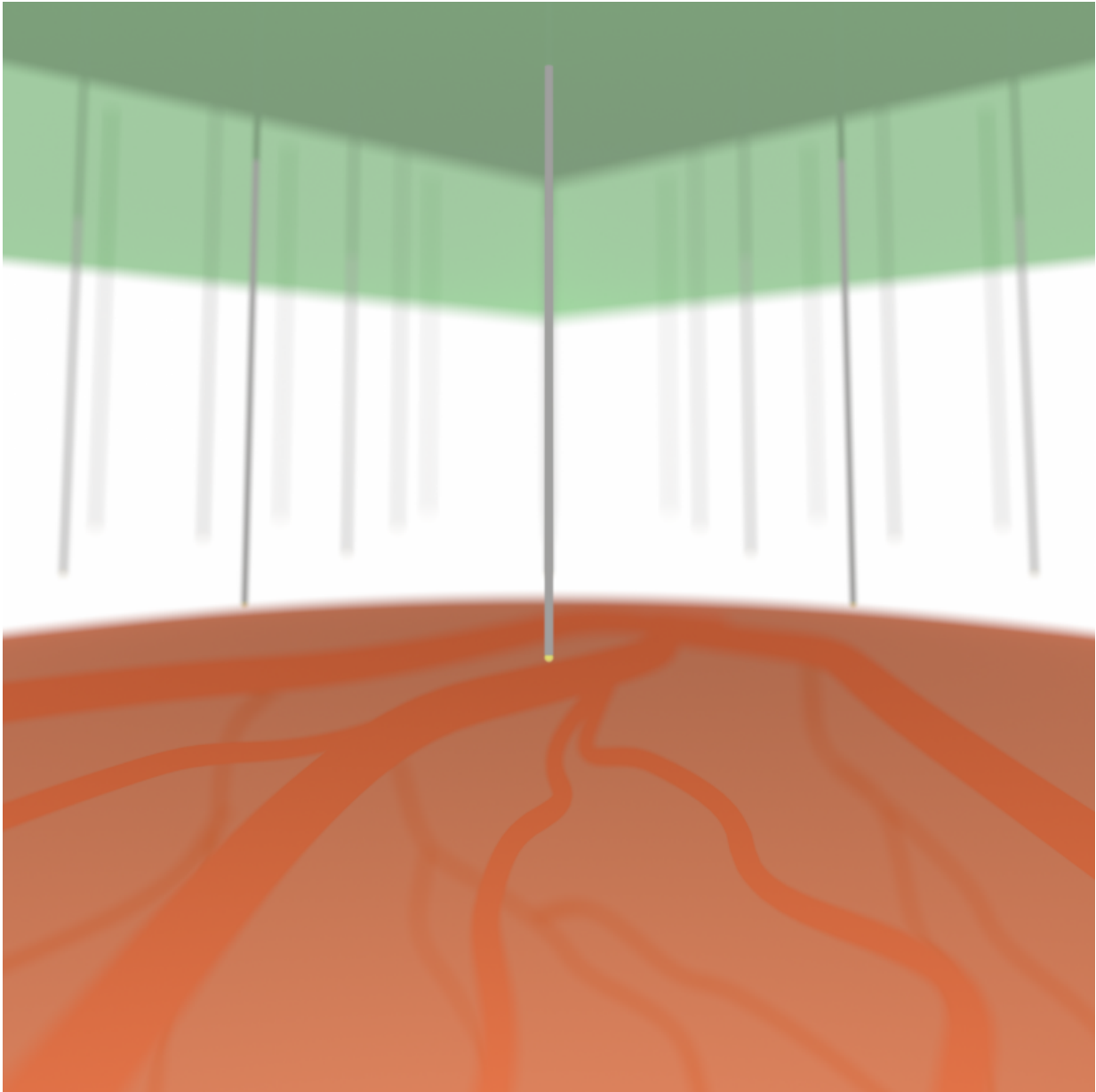


# Super-small needle technology for the brain

August 10 2015

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Flexible high-aspect-ratio microneedles penetrating brain tissue. Credit: (c)

Toyohashi University Of Technology

Microscale needle-electrode array technology has enhanced brain science and engineering applications, such as electrophysiological studies, drug and chemical delivery systems, and optogenetics.

However, one challenge is reducing the tissue/neuron damage associated with needle penetration, particularly for chronic insert experiment and future [medical applications](#). A solution strategy is to use microscale-diameter needles (e.g.,

A research team in the Department of Electrical and Electronic Information Engineering and the Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) at Toyohashi University of Technology has developed a methodology to temporarily enhance the stiffness of a long, high-aspect-ratio flexible microneedle (e.g., 500  $\mu\text{m}$  in length), without affecting the needle diameter and flexibility in tissue. This has been accomplished by embedding a needle base in a film scaffold, which dissolves upon contact with [biological tissue](#). Silk fibroin is used as the dissolvable film because it has high biocompatibility, and is a known biomaterial used in implantable devices.

"We investigated preparation of a silk base scaffold for a microneedle, quantitatively analyzed needle stiffness, and evaluated the penetration capability by using mouse brains in vitro/in vivo. In addition, as an actual [needle](#) application, we demonstrated fluorescence particle depth injection into the brain in vivo, and confirm that by observing fluorescence confocal microscope" explained the first author, master's degree student Satoshi Yagi, and co-author PhD candidate Shota Yamagiwa.

The leader of the research team, Associate Professor Takeshi Kawano said: "Preparation of the dissolvable base scaffold is very simple, but this methodology promises powerful tissue penetrations using numerous high-aspect-ratio flexible microneedles, including recording/stimulation electrodes, glass pipettes, and optogenetic fibers." He added: "This has the potential to reduce invasiveness drastically and provide safer tissue penetration than conventional approaches."

**More information:** Satoshi Yagi, Shota Yamagiwa, Yoshihiro Kubota, Hirohito Sawahata, Rika Numano, Tatsuya Imashioya, Hideo Oi, Makoto Ishida, and Takeshi Kawano (2015). Dissolvable base scaffolds allow tissue penetration of high-aspect-ratio flexible microneedles. *Advanced Healthcare Materials*. Article first published online: 2 AUG 2015 [DOI: 10.1002/adhm.201500305](https://doi.org/10.1002/adhm.201500305)

Provided by Toyohashi University of Technology

Citation: Super-small needle technology for the brain (2015, August 10) retrieved 26 April 2024 from <https://medicalxpress.com/news/2015-08-super-small-needle-technology-brain.html>

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