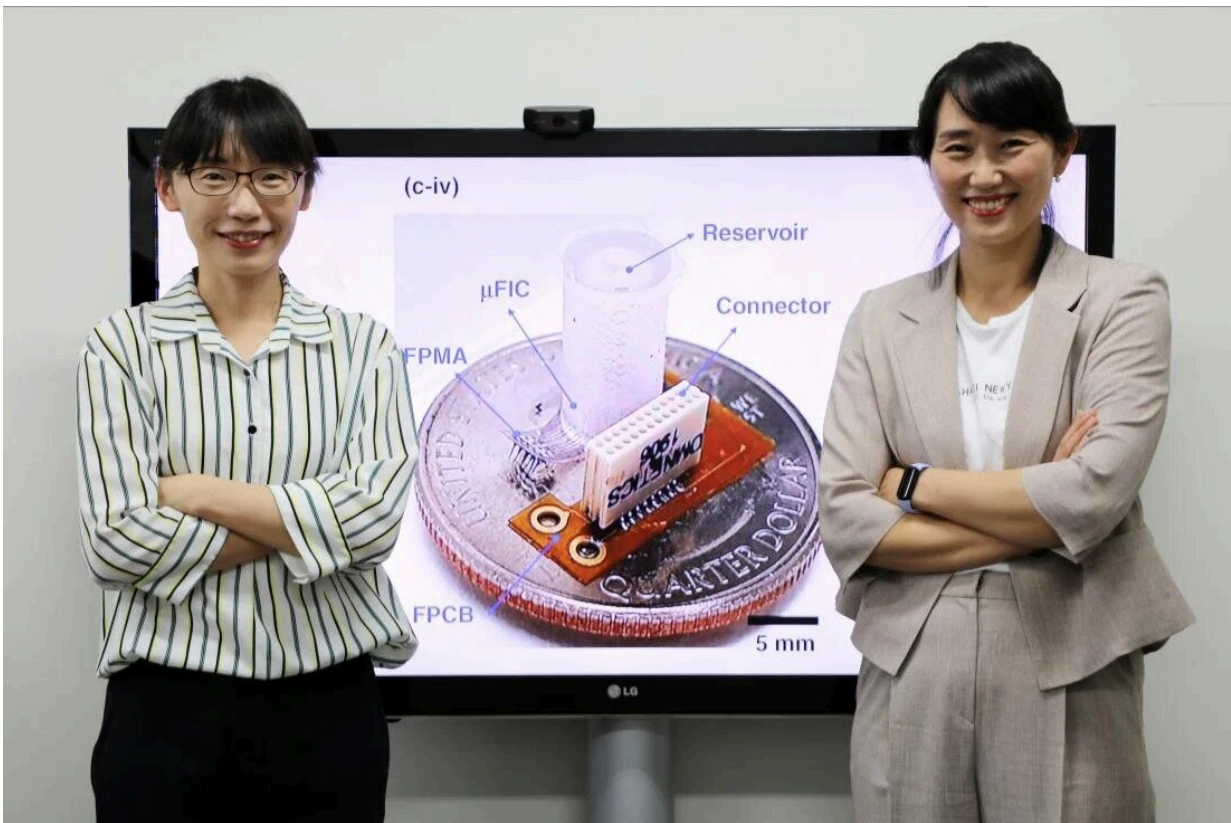


# A 3D multifunctional and flexible neural interface

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Prof. Sohee Kim and Dr. Yoo Na Kang from the Department of Robotics Engineering at DGIST standing in front of an image of their flexible neural interface. Credit: DGIST

Being able to measure the electrical activity of the brain has helped us

gain a much better understanding of the brain's processes, functions, and diseases over the past decades. So far, much of this activity has been measured via electrodes placed on the scalp (through electroencephalography (EEG)); however, being able to acquire signals directly from inside the brain itself (through neural interfacing devices) during daily life activities could take neuroscience and neuromedicine to completely new levels. A major setback to this plan is that, unfortunately, implementing neural interfaces has proven to be remarkably challenging.

The materials used in the minuscule electrodes that make contact with the neurons, as well as those of all connectors, should be flexible yet durable enough to withstand a relatively harsh environment in the body. Previous attempts at developing long-lasting [brain](#) interfaces have proven challenging because the natural biological responses of the body, such as inflammation, degrade the electrical performance of the electrodes over time. But what if we had some practical way to locally administer [anti-inflammatory drugs](#) where the electrodes make contact with the brain?

In a recent study published in *Microsystems & Nanoengineering*, a team of Korean researchers developed a novel multifunctional brain [interface](#) that can simultaneously register neuronal activity and deliver liquid drugs to the implantation site. Unlike existing rigid devices, their design has a flexible 3D structure in which an array of microneedles is used to gather multiple neural signals over an area, and thin metallic conductive lines carry these signals to an external circuit. One of the most remarkable aspects of this study is that, by strategically stacking and micromachining multiple polymer layers, the scientists managed to incorporate microfluidic channels on a plane parallel to the conductive lines. These channels are connected to a small reservoir (which contains the drugs to be administered) and can carry a steady flow of liquid toward the microneedles.

The team validated their approach through brain interface experiments on live rats, followed by an analysis of the drug concentration in the tissue around the needles. The overall results are very promising, as Prof. Sohee Kim from Daegu Gyeongbuk Institute of Science and Technology (DGIST), Korea, who led the study, remarks: "The flexibility and functionalities of our device will help make it more compatible with biological tissues and decrease adverse effects, all of which contribute to increasing the lifespan of the neural interface."

The development of durable multifunctional brain interfaces has implications across multiple disciplines. "Our device may be suitable for brain-machine interfaces, which enable paralyzed people to move robotic arms or legs using their thoughts, and for treating neurological diseases using electrical and/or chemical stimulation over years," says Dr. Yoo Na Kang of the Korea Institute of Machinery & Materials (KIMM), first author of the study.

**More information:** Yoo Na Kang et al, A 3D flexible neural interface based on a microfluidic interconnection cable capable of chemical delivery, *Microsystems & Nanoengineering* (2021). [DOI: 10.1038/s41378-021-00295-6](https://doi.org/10.1038/s41378-021-00295-6)

Provided by DGIST

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