# ELECTRONIC TATTOO GRAFTS GADGETS TO SKIN

The ultrathin device can stick to skin like a temporary tattoo and is powerful enough to read brain signals.

By Alyssa Danigelis
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The ultrathin device from silicon that can stick to skin like a temporary tattoo. Click to enlarge this image.
*University of Illinois*

## THE GIST

- Engineers created skinlike electronics that stick to the body like temporary tattoos.
- The device contains ultrathin silicon that gives it powerful semiconducting capabilities.
- Sticky silicon-based electronics could be used for painless diagnostics, communication, neonatal care, physical therapy and gaming.

Wearable electronics usually trade flexibility for computing power, but engineers have created a new ultrathin device from silicon that can stick to skin like a temporary tattoo and are powerful enough to read brain signals.

"You can't change the biology so you really have to redefine the nature of electronics," said John A. Rogers, the University of Illinois engineering professor who led the development. He and his colleagues describe the skinlike electronic device in a forthcoming article of the journal *Science.*

Over the past several decades, most approaches to wearable electronics involved skinlike electronic platform creating points of contact, like electrodes, or focused on flexibility over computing capabilities. "It throws away essentially all of the scientific knowlUltrathin Electronics Become Second Skinedge and engineering know-how that's already been built up around silicon," Rogers said.

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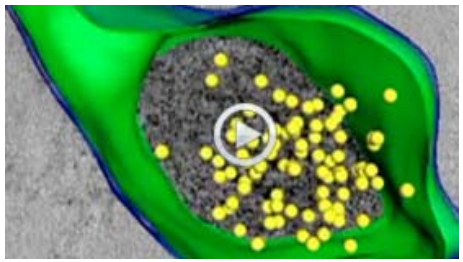
So he kept at it, taking silicon from a half-millimeter thick wafer to a nanomembrane.

The new platform has silicon-based circuitry fabricated in a wavy structure dubbed "filamentary serpentine" that allows it to form a web of electronics. Those circuits are integrated into extremely thin rubber sheets that naturally stick to skin without the need for adhesive.

The researchers took continuous measurements successfully for 6 hours and found that there was no irritation or degradation caused when leaving the devices on for 24 hours. Rogers says that after about two weeks, naturally-occurring skin exfoliation would make it difficult for the electronics to stay in place.

Rogers and his team have focused primarily on exploring medical applications for the technology. When laminated on the forehead, the heart and the forearm, the device worked as well as standard electrodes in measuring activity. On the throat it was sensitive enough to record throat muscle contractions during vocalization, which means it could help people with difficulty speaking.



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The unobtrusive nature of the skinlike electronics make them ideal for monitoring those with problems such as sleep disorders or diseases affecting the larynx that would otherwise need bulky uncomfortable electrodes and devices, Rogers said. Using such lightweight patches could be beneficial to neonatal care for premature babies, he added.

This nearly invisible technology isn't entirely passive, either. Working with a team from Johns Hopkins, the researchers found that by placing patches on rat legs they were able to make the legs move back and forth through electrical stimulation. Stimulating muscle without constraining it is important for physical rehabilitation, Rogers said.

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"There are a lot of advancements that can happen immediately if you take more sophisticated existing conventional devices and put them in this spiderweb layout," Rogers said. The technology could one day be used by gamers, too. Although Rogers admits that the capability is still primitive, he demonstrated that speaking into a patch on the throat could control the direction of a cursor.

Next, Rogers and his colleagues plan to engineer and demonstrate fully-integrated wireless communication capability for their platform so it can transmit information more easily. The ultimate goal is to commercialize this technology through Mc10, a startup based in Cambridge, Massachusetts, that Rogers co-founded in 2008. Eventually he'd also like to enable the electronics to process dead skin cells, allowing the device to stick much longer.

Qibing Pei is a materials science and engineering professor at UCLA who works on making polymer electronic devices that are extremely stretchy. He and his colleagues created wearable electronic displays from intrinsically stretchable polymer LEDs. He said Rogers' platform has very good potential.

"The most interesting part to me is that he manages to make the metal electrode, the semiconductor devices, extremely small and structured," he said. The filamentary serpentine devices can also stretch up to 30 percent, Pei added. "It's quite compatible with the skin."



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Hmmmmm.....reminds me of a song....

Woe to you, oh earth and sea
For the Devil sends the beast with wrath
Because he knows the time is short
Let him who hath understanding
Reckon the number of the beast
For it is a human number
Its number is six hundred and sixty six

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**JC**
LOL!!!!!!!!!!!!!!!!

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OW!..oh my Side!

LOL!!!...LOL!!!!!!!!

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**Dakota B. Zinani**
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