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**Fingertip tingle enhances a surgeon's sense of touch**

16:25 10 August 2012 by [Hal Hodson](#)  
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OUR fingers are precision instruments, but there are plenty of things they are not sensitive enough to detect. Now we can augment their talents – using wearable electronic fingertips that provide tingling feedback about whatever we touch.

[John Rogers](#) of the University of Illinois at Urbana-Champaign and colleagues have designed a flexible circuit that can be worn over the fingertips. It contains layers of gold electrodes just a few hundred nanometres thick, sandwiched between layers of polyimide plastic to form a "nanomembrane". This is mounted on a finger-shaped tube of silicone rubber, allowing one side of the circuit to be in direct contact with the fingertips. On the other side, sensors can be added to measure pressure, temperature or electrical properties such as resistance.

People wearing the device receive electrostatic stimulation – a tingling sensation caused by a small voltage applied to the skin. The size of the voltage is controlled by the sensor and varies depending on the properties of the object being touched.

Surgical gloves are one potential application. Rogers, who worked with colleagues at Northwestern University in Evanston, Illinois, and Dalian University of Technology in China, says gloves fitted with the nanomembrane could sense the thickness or composition of tissue via its electrical properties. A surgeon could also whittle away at the tissue using a high-frequency alternating current supplied by a battery attached at the wrist and delivered via the nanomembrane itself, says Rogers.

Fiorenzo Omenetto at Tufts University in Medford, Massachusetts, is impressed. "The work sets the stage for a new generation of devices," he says.

There are applications beyond surgery, too. MC10, the company commercialising the technology, is running animal trials of a nanomembrane "sock" that can be wrapped around the heart. This provides a 3D map of its electrical activity, useful in treating irregular heartbeat.

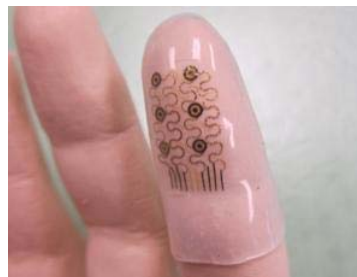
MC10 is also working with medical device company Medtronic to use the membrane inside the heart, sending it in on a limp balloon, which is then inflated to push the membrane onto the heart's interior walls.

Rogers says MC10 is also collaborating with sportswear firm Reebok on a product to be launched by the end of this year. The aim is to build a "body-worn piece of electronics" designed for contact sports, although Rogers declined to say exactly how it will be used.

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Nanotechnology at your fingertips (Image: John Rogers/University of Illinois at Urbana-Champaign)

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