'Electronic Skin' Grafts Gadgets to Body

by Jon Cartwright on 11 August 2011, 2:01 PM | 6 Comments

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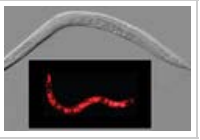

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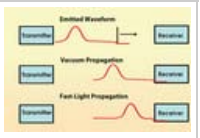

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He may have had a laser in his watch and a radio in his lighter, but even James Bond didn't sport gadgets tattooed to his skin. Now he could, thanks to the development of ultrathin electronics that can be placed on the skin as easily as a temporary tattoo. The researchers hope the new devices will pave the way for sensors that monitor heart and brain activity without bulky equipment, or perhaps computers that operate via the subtlest voice commands or body movement.

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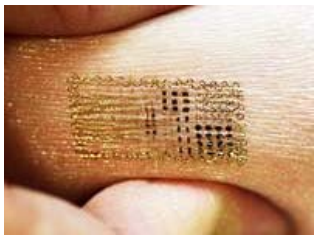

Electronic tattoo. Wearing high-tech gadgets has never been so easy, thanks to the latest advance in bendy electronics.

Credit: John A. Rogers

Stretchy and bendy electronics have been around for a few years. One approach is to write circuits onto materials that are already flexible, such as ink on paper, so gadgets can be folded and put away. Another is to make the circuits themselves flexible. In 2008, for example, engineers at the University of Tokyo created a conductive material that looked a bit like a fishnet stocking. Made of carbon nanotubes and rubber, it could stretch by more than a third of its natural length, possibly enough to make robots become more agile.

The problem with these past attempts, says materials scientist John Rogers of the University of Illinois, Urbana-Champaign, is that none of them has been as stretchy and as bendy as human skin. That's a shame, because scientists have had grand visions for integrating the skin with electronics, from medical sensors to music players or cell phones that you can literally wear on your arm.

Now, Rogers and his colleagues at Urbana-Champaign and other institutions in the United States, Singapore, and China have come up with a form of electronics that almost precisely matches skin's mechanical properties. Known as epidermal electronics, they can be applied in a similar way to a temporary tattoo: you simply place it on your skin and rub it on with water (see video). The devices can even be hidden under actual temporary tattoos to keep the electronics concealed.

"The skin represents one of the most natural places to integrate electronics," says Rogers, whose group's paper appears online today in *Science*. "As the largest organ in our body, and our primary sensory mode of interaction with the

Rub on, peel off. So-called epidermal electronics is as simple to apply, and remove, as a temporary tattoo.
Credit: John A. Rogers

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world, it plays a special role."

The new technology is the product of advances in several areas. One is in the active circuit components—transistors, diodes, and other inherently stiff semiconductors—which Rogers's group has flattened and shrunk to the size of the tiniest bumps and wrinkles on the skin. Another is in the material on which these components are arranged: a sheet of rubbery "elastomer" that mimics the mass, thickness, and elasticity of the skin. Like an extra-clingy plastic wrap, the elastomer sticks to the skin naturally, using only the weak, short-range, attractive forces that always exist between neighboring molecules for adhesion. It can stay attached for over 24 hours almost anywhere on the body.

The third important ingredient is the circuit's arrangement. Place the components and wires too close and they will stiffen the device, making it liable to tear. So Rogers's group uses a computer program to predict all the stresses and strains that arise with different designs and then picks the one that keeps elasticity at a maximum.

In one experiment, the group applied a device the size of a postage stamp to a person's chest to pick up the electrical signals produced by the heart. The measurements agreed "remarkably well" with those produced by a hospital electrocardiogram, the researchers say, without relying on potentially uncomfortable gels or tape. In another experiment, the group applied a device containing a microphone to a person's throat and fed the signal to a computer. The computer could recognize four different words: "up," "down," "left," and "right." This technology could eventually help people with some disabilities control computers, the researchers say.

Physicist Siegfried Bauer of Johannes Kepler University in Linz, Austria, agrees that epidermal electronics have important medical applications. However, he notes that the technology needs to be tested with a range of skin conditions, from dry to sweaty. "Circuits must allow for transpiration and breathing," he says.

Rogers and his colleagues have separately demonstrated that they can add other useful features to epidermal electronics. Solar cells could one day power the devices without an external source; meanwhile, signals recorded by the devices could be transmitted to a base station wirelessly with antennas. In the long term, Rogers believes the technology could provide an electronic link to the body's most subtle processes, including the movement of enzymes and antibodies, to track the path of disease. "Ultimately, we think that [our] efforts can blur the distinction between electronics and biology," he says.

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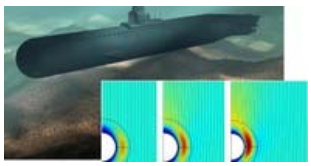

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This is just like from one of my fav scifi writers. Check out Pandora Star and Judas Unchained by Peter F Hamilton to see what I'm talking about. People in these books have organic circuitry tattoos.
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mhp
How is it powered?
How does it send output signals to a an external device---e.g. a computer?
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sfobear
Witness the birth of the BORG. Resistance is FUTILE.
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Cru
The computer could recognize four different words: "up," "down," "left," and "right."
===
The most important part is that the wearer wasn't vocalizing those words.
"Telepathy" is on it's way.
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Not Important
"In another experiment, the group applied a device containing a microphone to a person's throat and fed the signal to a computer. The computer could recognize four different words: "up," "down," "left," and "right." This technology could eventually help people with some disabilities control computers, the researchers say."

Missed the part about the microphone and throat, huh?
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Amanda & Chris Ek
Telepathy is far from on its way.. the best example of computers reading the human mind in its pure form is detecting the smallest voltage differences on the surface of your head... for telepathy to take any steps you would need over 1000 sensors most of which would require internal implants in your brain... I'm not seeing many takers for this, but in the lab type work on rodents and monkeys due to medical complication risks.
for a some what geeky but simplified illustration of some of the background work require to read and use brainwaves..
http://blog.makezine.com/archive/2011/05/collins-lab-brainwave-beats.html
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