technology today

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Fake Tattoo Can Monitor a Person's Vital Signs

Fake tattoos are about to go from being a novelty item and fashion statement to being a medical diagnostic tool. Professor John Rogers and his team at the University of Illinois have developed a prototype temporary tattoo that contains epidermal microelectronic circuits on a clear rubber transfer medium.

The team's temporary body art tattoos have a medical function. They are designed to monitor people's vital signs while they are up and about performing their normal daily activities. His prototype showed proof of concept as it measured body temperature, electrical signals from nearby muscles and organs, and also registered physical strain in the area where they were attached to the body.

The pirate tattoo in Photo 1 records the electrical activity of muscles and nerves when it is attached to a person's wrist. It is a micro-sized, camouflaged EMG (electromyography) machine. The tattoo layer just under the image of the pirate contains the epidermal electronics that pick up the body's electrical signals (Photo 2).

Photo 1

With further development, the team hopes to go from proof of concept to tattoos that can transmit the signals that they pick up from the body to a separate recording device that would be about the size of a small cellphone. Wireless communication is not yet possible, Rogers wrote in an email, adding, "we have shown functionality in the building block components for such systems (wireless transfer of information), but we do not yet have that capability in our tattoos. For now, as a temporary strategy to demonstrate functionality in the sensing part, we are using ultra-thin ribbon cables as a hard-wired connection."

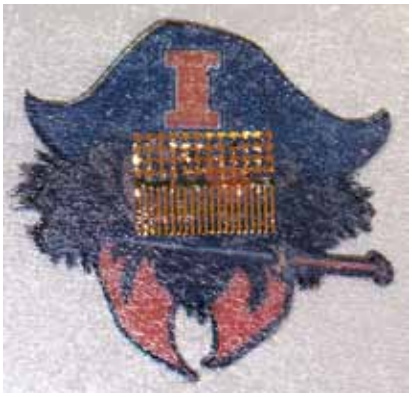

Photo 2

These tattoos can record other vital signs when attached to appropriate skin locations. If located on the chest, a tatoo can pick up and transmit the electrical signals from a person's heart, thereby performing an EKG (electrocardiogram) diagnostic test. If attached to a person's forehead it can record brain activity and gather the same electrical signals from the brain as those gathered by an EEG (electroencephalogram) machine. (To perform a true EEG test, they would have to be applied to numerous locations on a person's head.)

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The electronics in these tattoos are extremely thin and flexible. They are embedded in a transparent rubber transfer film that is made rigid by a paper backing until it is transferred

Photo 3

to a person's skin. The transfer process is very similar to the one children use to transfer fake tattoos. In this case, you place the transfer against the skin, rubber side down, and then use water to dissolve its paper backing.

The tattoos can bend and stretch without breaking or degrading their ability to gather electrical signals from the body. They are so strong and flexible that they can actually be poked without breaking. Photo 3 shows the tattoo's electronics without the overlay of a camouflage layer so you can see just how much poking the device can take without breaking.

Since the electronic circuits used in the tattoos are so tiny, they are also very energy efficient. The goal is for each tattoo to have photocells onboard to generate the electricity they will need to function. To address situations in which light isn't an available power source, the goal is to recharge the tiny internal power supply by electrical induction. Rogers's team has already tested a tiny coil onboard the tattoo to see if electric current can pass wirelessly between the tattoo and a power source.

There is no doubt that it is going to take time for this technology to move from the laboratory to a doctor's office. The fact that these tattoos can transmit electrical signals from the human body to a computer could lead to nonmedical uses. In one demonstration, Rogers showed that the electrical signals gathered from a person's neck muscles could be used to control a video game. Tests performed to date definitely raise the possibility that this tattoo-computer interface could be used to control artificial limbs.

You can view a National Science Foundation video on this technology online at www.nsf.gov/news/news_videos.jsp?cntn_id=121343&media_id=70971&org=NSF. You can also view videos by John Rogers and his team at http://news.illinois.edu/news/11/0811skin_electronics_JohnRogers.html.

Recalling the Facts

1. What is the most significant difference between this tattoo vital sign monitoring system and our current medical monitoring systems?

2. How might this technology eventually help people with different handicapping conditions? td

