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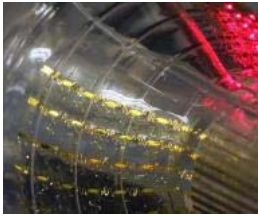
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Stretchy electronics aid heart surgery

New balloon catheters may help cardiologists treat common problems

By Daniel Strain

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ENLARGE

THE WORKS

This tricked-out balloon catheter carries temperature, touch and electrical pulse sensors, plus LED lights, just to give it that *Tron* feel. Scientists expect the new tool will help improve cardiac care.

Dae-Hyeong Kim

The latest tool for heart surgery is a lot like a balloon animal, with an electronic twist.

By wiring up inflatable devices called balloon catheters with new elastic electronic devices, doctors may be able to measure precise temperatures and even deliver tiny electric zaps to steady a heartbeat, all from inside a blood vessel. That ability could make a common procedure for heart arrhythmia called ablation therapy faster and more effective, an international team reports in the March 6 *Nature Materials*.

Like expert weavers, doctors can thread balloon catheters — thin tubes carrying an expandable balloon at their tip, useful for opening up clogged arteries — through blood vessels. Once there, though, the catheters can't provide much in the way of diagnostic information, says study coauthor John Rogers. "Balloon catheter technology today — it's used just as a dumb mechanical implement," says Rogers, a materials science researcher at the University of Illinois at Urbana-Champaign.



ENLARGE**MAP AND ZAP**

This fully inflated "smart" balloon catheter, seen here outside an animal heart, can map electric pulses as well as zap tissue to keep out-of-control pulses from spreading.

Kevin Dowling

Electronics could deliver more sensory abilities to these devices but don't work well on stretchy surfaces, Rogers says. Picture a clown making a balloon poodle: Going from limp material to canine takes a lot of stretching and twisting, not good for brittle sensors. The solution is to think thin: "If you make any material thin enough it becomes flexible just by virtue of that thin nature," he says.

The final product resembles a traffic grid: Ultrathin wires run east to west and north to south on the surface of the catheter, joining at major intersections. Built-in curves also help the mesh stretch out like a telephone cord, Rogers says. And as in real cities, the intersections — in this case, nodes also built from thin wafers of materials such as silicone — are where the action happens. At the nodes, the team can add in any number of multiuse components, from sensors that record tissue temperature and electrical pulses in the heart to electrodes capable of zapping tissue with tiny currents.

Study coauthor Marvin Slepian says that the new devices could reduce the duration of surgery for atrial fibrillation, which would help cut a patient's risk from the procedure. This common heart irregularity occurs when the atria, the top two heart chambers, beat wildly out of control. In ablation therapy, doctors go into the heart and surrounding blood vessels with catheters — this time sans balloons — and literally zap tissue to block the path of rogue pulses. It's effective but also time-consuming: Doctors need to use two catheters, one to map the flow of electricity through cardiac tissue and the second to deliver shocks. But the team's new catheters carry a variety of electronics all on the same balloon. "We can map and zap at the same time," says Slepian, a cardiologist at the University of Arizona in Tucson.

Two-in-one catheters could also give cardiologists the chance to better measure their progress during ablation. "That could allow for more refined burning of specific tissue, minimizing damage to healthy tissue," says Deepak Bhatt, a Harvard Medical School cardiologist in Boston and American Heart Association spokesperson.

The catheters still need to prove themselves in a series of clinical trials, says Hugh Calkins, a cardiologist at the Johns Hopkins Heart and Vascular Institute in Baltimore. But, he says, cardiology depends on the advent of new gadgets like these: "It's a very exciting technology."

Smart catheters are just the beginning, Rogers adds. The team also hooked up stretchy surgical gloves with similar probes and sensors,

which could someday allow surgeons wearing the gloves to monitor electric pulses during open-heart surgery. Now, that's one wild balloon animal.

SUGGESTED READING :

Nathan Seppa. Searing the heart for the better. Science News. February 27, 2010. 177(5):12

CITATIONS & REFERENCES :

D.H. Kim. Materials for multifunctional balloon catheters with capabilities in cardiac electrophysiological mapping and ablation therapy. Nature Materials. Published online March 6, 2011. DOI: 10.1038/nmat2971