

World's smallest pacemaker launched: Smaller than a grain of rice, powered by light energy, self-destructs after use

Engineers at Northwestern University have successfully developed a tiny pacemaker that can be injected into the body without being invasive.

Engineers at Northwestern University have developed a tiny pacemaker that can be injected into the body without being invasive. Designed to fit into an injection tip, the device offers a new way to treat heart problems, especially in babies born with congenital heart defects.

This 'smaller than a grain of rice' pacemaker is designed for temporary heart pacing needs. It comes with a flexible, wireless wearable that attaches to the patient's chest. The wearable monitors heart activity and uses light pulses to activate the pacemaker whenever it detects an irregular heartbeat. These light signals penetrate skin, bone, and muscle to ensure a steady heartbeat.

The most notable feature of the pacemaker is its ability to self-dissolve after it has completed its function. Made entirely of biocompatible materials, the device dissolves in body fluids, eliminating the need for surgery to remove it.

John A. Rogers, a bioelectronics researcher at Northwestern and leader of the development team, said:

We have developed the world's smallest pacemaker. There is an urgent need for temporary pacemakers in the pediatric cardiac surgery setting, and that is a use case where miniaturization is extremely important. In terms of the weight of the device on the body - the smaller the better.

The pacemaker's design is particularly useful for newborns, whose tiny, fragile hearts require precise, minimally invasive solutions. Igor Efimov, an experimental cardiologist at Northwestern and co-leader of the study, emphasized the application. "Our main motivation is children," Efimov said. "About 1 percent of children are born with congenital heart defects—whether they live in a low- or high-resource country. The good news is that these children only need temporary pacing after surgery. In about seven days or so, most patients' hearts will heal on their own. But those seven days are critical. Now, we can put this tiny pacemaker on a child's heart and stimulate it with a soft, gentle wearable device. And there's no need for additional surgery to remove it."

The study demonstrated the efficacy of the pacemaker in multiple tests involving both large and small animal models, as well as human hearts from deceased donors. This work builds on a previous collaboration between Rogers and Efimov, when they developed the first temporary, resorbable pacemaker. Temporary pacemakers are often required after surgery, either as a stepping stone to a permanent device or to aid recovery by restoring a normal heart rhythm.

The team hopes their work will meet the urgent needs of patients who need short-term cardiac support, especially infants recovering from surgery.

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