

# Building a drug delivery platform to regenerate heart tissue

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(Medical Xpress) -- While current heart-attack treatments mainly try to preserve healthy heart tissue, scientists have been finding compounds that can stimulate growth of new tissue – either by getting heart muscle cells (cardiomyocytes) to replicate, or by stimulating other nearby cells to become cardiomyocytes. The challenge lies in getting these regenerative factors into the damaged heart tissue. Now, researchers at Boston Children’s Hospital report success getting a sponge-like gel, soaked with one of these factors, to slowly release the medication into the space surrounding the heart, and from there into the damaged tissue.

The findings, in a large-animal model (swine), suggest a treatment approach that could be used relatively soon, since the material, called Gelfoam, is FDA-approved and is commonly used by surgeons and dentists to mop up blood and help stop bleeding.

In 2007, a team led by Bernhard Kuhn, MD, of the Department of Cardiology at Boston Children’s Hospital, showed that a recombinant peptide of a naturally-occurring compound called periostin, which can be given as a drug, effectively regenerated [heart tissue](#) in rats, increasing cell division, reducing scarring and improving [heart](#) function.

In the May 10 edition of the online journal *PLoS ONE*, Kuhn and Brian Polizzotti, PhD, a bioengineer working in his laboratory, describe their delivery system. “Our objective was to demonstrate a clinically translatable strategy for targeted, prolonged release of periostin peptide in the heart,” says Kuhn.

Kuhn, Polizzotti and colleagues combined the periostin peptide with Gelfoam, which soaked the drug up, and injected this mixture into the sac that surrounds the heart.

“We used the pericardial sac like a containment center,” explains Polizzotti.

To get the Gelfoam to release periostin peptide gradually, without the drug being washed away or broken down, they took advantage of natural physiology: Whenever Gelfoam comes in contact with a body fluid, like that inside the pericardial sac, a clot forms around it. It’s a first-line immune response that shields the body from something that might be harmful. (The clot never enters a blood vessel so poses no medical risk.)

“We used the body’s innate ability to respond to Gelfoam in this way to encapsulate the drug,” Polizzotti explains. “That enables the drug to be released over time and exert its beneficial effect.”

In a swine model of heart attack, they were able to prolong the periostin peptide’s release so that it occurred gradually over the course of seven days. The treatment appeared safe: There was no inflammatory response and no scarring in the heart.

The researchers also showed that the drug diffuses rapidly through injured but not [healthy heart](#) tissue, decreasing the potential for adverse reactions in neighboring normal tissue. After a [heart attack](#), the heart muscle becomes more permeable, allowing periostin peptide to diffuse easily into the damaged area.

In practical terms, the most important advantage of this approach is that it uses established procedures and FDA-approved devices, clearing some of the hurdles in getting it to the clinic. In the future, the researchers hope to apply it to treating children with congenital heart disease.

“Our approach may also serve as a platform for rapid testing of new pharmaceuticals targeting the heart,” adds Kuhn.

Shima Arab of the Department of Cardiology at Boston Children’s Hospital was a coauthor on the paper. The work was funded by the National Institutes of Health, the Department of Cardiology, and the Translational Research Program at Boston Children’s Hospital.

Provided by Children's Hospital Boston

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