

Scar tissue turned into heart muscle without using stem cells

26 April 2012

Scientists at Duke University Medical Center have shown the ability to turn scar tissue that forms after a heart attack into heart muscle cells using a new process that eliminates the need for stem cell transplant.

The study, published online April 26 in the journal [Circulation Research](#), used molecules called microRNAs to trigger the [cardiac tissue](#) conversion in a lab dish and, for the first time, in a living mouse, demonstrating the potential of a simpler process for tissue regeneration.

If additional studies confirm the approach in [human cells](#), it could lead to a new way for treating many of the 23 million people worldwide who suffer [heart failure](#), which is often caused by [scar tissue](#) that develops after a heart attack. The approach could also have benefit beyond heart disease.

"This is a significant finding with many therapeutic implications," said Victor J. Dzau, M.D., a senior author on the study who is James B. Duke professor of medicine and chancellor of health affairs at Duke University. "If you can do this in the heart, you can do it in the brain, the kidneys and other tissues. This is a whole new way of regenerating tissue."

To initiate the regeneration, Dzau's team at Duke used microRNAs, which are molecules that serve as master regulators controlling the activity of multiple genes. Tailored in a specific combination, the microRNAs were delivered into scar [tissue cells](#) called fibroblasts, which develop after a heart attack and impair the organ's ability to pump blood.

Once deployed, the microRNAs reprogrammed fibroblasts to become cells resembling the [cardiomyocytes](#) that make up heart muscle. The Duke team not only proved this concept in the laboratory, but also demonstrated that the cell conversion could occur inside the body of a mouse - a major requirement for regenerative medicine to

become a potential therapy.

"This is one of the exciting things about our study," said Maria Mirosou, PhD, assistant professor of cardiology at Duke and a senior author of the study. "We were able to achieve this tissue conversion in the heart with these microRNAs, which may be more practical for direct delivery into cells and allow for possible development of therapies without using genetic methods or transplantation of stem cells."

The researchers said using microRNA for [tissue regeneration](#) has several potential advantages over genetic methods or transplantation of stem cells, which have been difficult to manage inside the body. Notably, the microRNA process eliminates technical problems such as genetic alterations, while also avoiding the ethical dilemmas posed by stem cells.

"It's an exciting stage for reprogramming science," said Tilanthi M. Jayawardena, PhD, first author of the study. "It's a very young field, and we're all learning what it means to switch a cell's fate. We believe we've uncovered a way for it to be done, and that it has a lot of potential." The approach will now be tested in larger animals. Dzau said therapies could be developed within a decade if additional studies advance in larger animals and humans.

"We have proven the concept," Dzau said. "This is the very early stage, and we have only shown that it is doable in an animal model. Although that's a very big step, we're not there yet for humans."

Provided by Duke University Medical Center

APA citation: Scar tissue turned into heart muscle without using stem cells (2012, April 26) retrieved 15 September 2019 from <https://medicalxpress.com/news/2012-04-scar-tissue-heart-muscle-stem.html>

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