

How do you mend a broken heart? Maybe someday with stem cells made from your skin (Video)

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(PhysOrg.com) -- A little more than a year after University of Wisconsin-Madison scientists showed they could turn skin cells back into stem cells, they have pulsating proof that these "induced" stem cells can indeed form the specialized cells that make up heart muscle.

In a study published online today (Feb. 12) in *Circulation Research*, a journal of the American Heart Association, UW-Madison School of Medicine and Public Health professor of medicine Tim Kamp and his research team showed that they were able to grow working heart-muscle cells (cardiomyocytes) from induced pluripotent stem cells, known as iPS cells.

The heart cells were originally reprogrammed from human skin cells by James Thomson and Junying Yu, two of Kamp's co-authors on the study.

"It's an encouraging result because it shows that those cells will be useful for research and may someday be useful in therapy," said Kamp, who is also a cardiologist with UW Health. "If you have a heart failure patient who is in dire straits — and there are never enough donor hearts for transplantation — we may be able to make heart cells from the patient's skin cells, and use them to repair heart muscle. That's pretty exciting."

It's also a few more discoveries away. The researchers used a virus to insert four transcription factors into the genes of the skin cell,

reprogramming it back to an embryo-like state. Because the virus is taken up by the new cell, there is a possibility it eventually could cause cancer, so therapies from reprogrammed skin cells will likely have to wait until new methods are perfected.

Still, the iPS cardiomyocytes should prove immediately useful for research. And Kamp said the speed at which knowledge is progressing is very encouraging.

Jianhua Zhang, lead author on the study, noted that it took 17 years, from when a mouse embryonic stem cells were first created in 1981, to 1998, when Thomson created the first human embryonic stem cells. In contrast, the first mouse iPS stem cells were created in 2006, and Thomson and Yu published their paper in November 2007, announcing the creation of human iPS stem cells that began as a skin cells.

While research on embryonic stem cells is controversial, because it destroys a human embryo, lessons learned through such research apply to current work with iPS cells made from adult cells.

"That's one of the important things that have come out of the research with embryonic stem cells, it taught us how human pluripotent stem cells behave and how to work with them," Kamp says. "Things are able to progress much more quickly thanks to all the research already done with embryonic stem cells."

Many types of heart disease have known genetic causes, so creating cardiomyocytes grown from patients who have those diseases will likely be some of the next steps in the research. One of Kamp's colleagues, Clive Svendsen, a UW-Madison School of Medicine and Public Health professor of neurology and anatomy, has grown the iPS cells into disease-specific neural cells. Kamp and Svendsen are also on the faculty of the Waisman Center and the Stem Cell and Regenerative Medicine Center.

Kamp's latest research, proving that iPS cells can become functional heart cells, is just one step along the way to better understanding and treatment of disease.

"We're excited about it, because it's the some of the first research to show it can be done, but in the future, we'll probably say, 'Well, of course it can be done,'" he says. "But you don't know until you do it. It's a very mysterious and complicated dance to get these cells to go from skin cells to stem cells to heart cells."

Source: University of Wisconsin-Madison

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