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Biotechnology Builds a New Heart

Stem cells injected into 'skeleton' of animal organ was beating in just 8 days

By Ed Edelson

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SUNDAY, Jan. 13 (HealthDay News) -- An organ-building biotechnology that could create transplantable hearts using stem cells from the recipients themselves has passed important laboratory tests, researchers report.

The technique, called whole organ decellularization, has been used to create functioning heart tissue, according to a report in the Jan. 13 issue of *Nature Medicine* by a team at the University of Minnesota Center for Cardiovascular Repair.

What the scientists did first was to use detergents and other chemicals to wash out all the old heart cells from rat and pig hearts, explained lead investigator Doris Taylor, who is director of the center. What was left was a scaffold of tubes that once were the organ's blood vessels. Stem cells were then injected into that scaffold, where they were supplied with nutrients that allowed them to grow to create a new organ. Within eight days, the hearts were pumping.

The basic technology is not new, Taylor said. It is being used to create many of the heart valves that are implanted in current operations, she said. However, heart valves are relatively small.

"We have done it on the scale of a pig heart, which is the size and scale of a human heart," she said. "A human heart would be the next step, but we want to perfect the technique first."

The Minnesota researchers have applied for a patent on the combination of agents they use to decellularize an organ the size of a human heart and provide nutrients to the

implanted stem cells.

"Multiple things" must be done before a human trial can be attempted, Taylor said. "We are moving to larger organs, making sure we can get enough cells in to repopulate the entire heart, and also, if it is transplantable, to keep it alive for a long time," she said.

The biotechnology might be able to bypass a major impediment to organ transplants, the need to use tissue that is compatible with a recipient's immune system, Taylor said. "In theory, we could be able to use stem cells from a recipient's body to regenerate a heart," she said. "We could rebuild a heart that is immunologically similar to yours."

The Minnesota work "fits right in with other work in regenerative medicine," said Dr. Stephen Badylak, a professor of surgery at the University of Pittsburgh McGowan Institute for Regenerative Medicine. The center, like a number of relatively new facilities around the country, concentrates on work with stem cells, which have the potential of becoming almost any specialized cell within the body.

"Stem cells will respond depending on what they see around them," Badylak said. "What they are doing is to provide a lot of favorable signals for stem cells to become heart cells. They take stem cells that want to become heart cells and make them act appropriately. It sounds great."

In the United States, 5 million people live with heart failure, and roughly 50,000 of those patients die each year while awaiting a donor heart, according to the study.

The newly reported work "provides great proof of principle that you can get heart tissue to form," Badylak said. "The next key is to say how you can use this information therapeutically. The next proof of principle is to put it into a patient that needs it."

The schedule for such an attempt is not clear, Taylor said. "We are certainly several years away, but not tens of years away" from a human transplant trial, she noted.

More information

Basic facts about stem cells are provided by the [National Institutes of Health](#).

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