MedicalXpress

Researchers create beating heart in laboratory

January 13 2008

University of Minnesota researchers have created a beating heart in the laboratory. By using a process called whole organ decellularization, scientists from the University of Minnesota Center for Cardiovascular Repair grew functioning heart tissue by taking dead rat and pig hearts and reseeding them with a mixture of live cells. The research will be published online in the January 13 issue of *Nature Medicine*.

“The idea would be to develop transplantable blood vessels or whole organs that are made from your own cells,” said Doris Taylor, Ph.D., director of the Center for Cardiovascular Repair, Medtronic Bakken professor of medicine and physiology, and principal investigator of the research.

Nearly 5 million people live with heart failure, and about 550,000 new cases are diagnosed each year in the United States. Approximately 50,000 United States patients die annually waiting for a donor heart.

While there have been advances in generating heart tissue in the lab, creating an entire 3-dimensional scaffold that mimics the complex cardiac architecture and intricacies, has always been a mystery, Taylor said.

It seems decellularization may be a solution – essentially using nature’s platform to create a bioartifical heart, she said.

Decellularization is the process of removing all of the cells from an

organ – in this case an animal cadaver heart – leaving only the extracellular matrix, the framework between the cells, intact.

After successfully removing all of the cells from both rat and pig hearts, researchers injected them with a mixture of progenitor cells that came from neonatal or newborn rat hearts and placed the structure in a sterile setting in the lab to grow.

The results were very promising, Taylor said. Four days after seeding the decellularized heart scaffolds with the heart cells, contractions were observed. Eight days later, the hearts were pumping.

“Take a section of this ‘new heart’ and slice it, and cells are back in there,” Taylor said. “The cells have many of the markers we associate with the heart and seem to know how to behave like heart tissue.”

“We just took nature’s own building blocks to build a new organ,” said Harald C. Ott, M.D., co-investigator of the study and a former research associate in the center for cardiovascular repair, who now works at Massachusetts General Hospital. “When we saw the first contractions we were speechless.”

Researchers are optimistic this discovery could help increase the donor organ pool.

In general, the supply of donor organs is limited and once a heart is transplanted, individuals face life-long immunosuppression, often trading heart failure for high blood pressure, diabetes, and kidney failure, Taylor said.

Researchers hope that the decellularization process could be used to make new donor organs. Because a new heart could be filled with the recipient’s cells, researchers hypothesize it’s much less likely to be

rejected by the body. And once placed in the recipient, in theory the heart would be nourished, regulated, and regenerated similar to the heart that it replaced.

“We used immature heart cells in this version, as a proof of concept. We pretty much figured heart cells in a heart matrix had to work,” Taylor said. “Going forward, our goal is to use a patient’s stem cells to build a new heart.”

Although heart repair was the first goal during research, decellularization shows promising potential to change how scientists think about engineering organs, Taylor said. “It opens a door to this notion that you can make any organ: kidney, liver, lung, pancreas – you name it and we hope we can make it,” she said.

Source: University of Minnesota