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Heart disease: Research off the beating patch

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Research group leader Steven Goldman, MD, (right) and pre-doctoral Fellow Jordan Lancaster look at the microscopic image of a synthetic fiber mesh with beating heart muscle cells. Credit: University of Arizona

It is an amazing sight: What looks like a tiny beating heart is actually a piece of synthetic, gauze-like mesh, barely the size of a fingernail, floating in a Petri dish. And yet it keeps squeezing away, nice and rhythmically.

Researchers at The University of Arizona's Sarver Heart Center and the Southern Arizona Veterans Administration Health Care System (SAVAHCS) have come a step closer to repairing hearts damaged by a heart attack or weakened by chronic heart failure.

"We have developed a delivery system that allows us to introduce living, healthy heart muscle cells into damaged areas of the heart in a way that is much more efficient than the conventionally practiced method of injecting cells into heart tissue," says study leader Steven Goldman, MD.

Unlike most existing approaches, in which cardiac cells with no supporting structure are injected into heart tissue, Goldman's group uses a patch (Theregen Inc. San Francisco) made from microscopically thin fibers that serve as a scaffold to which the cells can adhere.

The group's latest achievements have attracted the attention of the American Heart Association, who picked the research as one of the most noteworthy achievements of this year's Cardiovascular Sciences Annual Conference in Las Vegas, Nev.

"Ultimately, we hope to use our system in patients with chronic heart failure and, possibly, to prevent heart failure in patients who had a heart attack," says Jordan Lancaster, BS, a pre-doctoral fellow in Dr. Goldman's lab who will present the research at the meeting on July 21, 2009.

Dr. Goldman and his team discovered that when they "seed" a vicryl mesh patch with a sufficiently large number of heart muscle cells (2.5 million or more), the cells start behaving just like their counterparts in the real organ: They contract synchronously at about 70 beats per minute even without any outside stimulation.

"Our work shows that we can put living cells onto a biodegradable, 3-dimensional scaffold in a way that not only allows them to survive, but to spontaneously beat in a coordinated fashion," says Lancaster.

In addition to demonstrating the feasibility of using a synthetic mesh as a means to deliver living heart cells into a diseased heart, the group has already shown that the patch improves left ventricular function and blood flow when implanted into damaged heart muscle in a rat model of myocardial infarction.

Dr. Goldman believes that the construct developed in his lab provides a better vehicle to introduce cells into damaged heart muscle than conventional cell transplantation techniques, in which cells are injected directly into the heart.

"I think the main reason for the disappointing results people have seen with those clinical trials is that the cells end up in an environment that is not optimal for them to thrive in. Scar tissue offers poor blood supply and weak structural support for new cells to attach, survive and grow. Our patch offers just what cardiac muscle cells need: structural support, increased blood supply and chemicals secreted by the supporting cells on the patch that help the heart muscle cells grow and function."

Source: University of Arizona (news : web)

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