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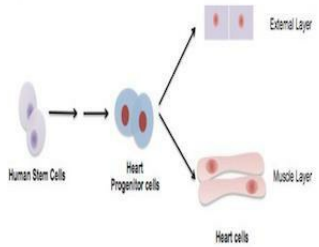
Stem Cells Used to Regenerate the Heart's External Layer



Penn State researchers have developed a process using human stem cells to generate the cells that cover the external layer of a human heart (epicardium cells), according to a study published in the journal Nature Biomedical Engineering. This method of generating epicardium cells could be useful in clinical applications, for patients who suffer a heart attack.

"Heart attacks occur due to blockage of blood vessels. This blockage stops nutrients and oxygen from reaching the heart muscle, and muscle cells die. These muscle cells cannot regenerate themselves, so there is permanent damage, which can cause additional problems," explains lead author Xiaojun Lance Lian, assistant professor of biomedical engineering and biology. "These epicardium cells could be transplanted to the patient and potentially repair the damaged region."

This study builds on the Penn State's previous research (2012) in which Lian's team succeeded in producing myocardium muscle cells from human stem cells. The method included treating human stem cells with chemicals that sequentially activate and inhibit Wnt signalling pathway, turning the stem cells into myocardial cells. Myocardium, the middle of the heart's three layers, is the thick, muscular part that contracts to drive blood through the body.

See Also: Stem Cell Delivery Can Improve Cardiac Function After Infarction

The Wnt signalling pathway is a group of signal transduction pathways made of proteins that pass signals into a cell using cell-surface receptors.

The research team needed to provide the cardiac progenitor cells with additional information in order for them to generate into epicardium cells. Prior to this study, the researchers didn't know what that information was. "Now, we know that if we activate the cells' Wnt signalling pathway again, we can re-drive these cardiac progenitor cells to become epicardium cells, instead of myocardium cells," says Lian.

During their study, the researchers engineered the human stem cells to become reporter cells, meaning these cells expressed a fluorescent protein only when they became epicardium cells. In addition to generating the epicardium cells, the researchers also can keep them proliferating in the lab after treating these cells with a cell-signalling pathway Transforming Growth Factor Beta (TGF) inhibitor.

The group's results bring them one step closer to regenerating an entire heart wall. Through morphological assessment and functional assay, the researchers found that the generated epicardium cells were similar to epicardium cells in living humans and those grown in the laboratory.

The team will continue working together to further their research on regenerating endocardium cells (the heart's inner layer). "We are making progress on that inner layer, which will allow us to regenerate an entire heart wall that can be used in tissue engineering for cardiac therapy," Lian adds.

Source: Penn State
Image Credit: Penn State

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