Method developed to 'print' replacement tissues using stem cells

NUI Galway and start-up Poly-Pico aim to use process to grow tissues for transplants

Prof Frank Barry, scientific director of the Regenerative Medicine Institute at NUI Galway, with PhD student Babu Rajendra Prasad. Photograph: Joe O'Shaughnessy

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By using tiny cartridges dispensing one stem cell at a time, Galway-based researchers may soon be able to literally "print" the scaffold of a healthy human tissue, and let it grow to become a therapeutic transplant.

When the Regenerative Medicine Institute at NUI Galway and Irish start-up company Poly-Pico Ltd recently joined forces for a trial "proof-of-concept" experiment, the results were spectacular.

They were able to dispense tiny drops from a cartridge filled with a stem cell mixture, each drop containing no more than a single stem cell.

"Now imagine that we have five dispensing cartridges, each containing a different type of programmed stem cell," said Frank Barry, professor of cellular therapy and scientific director of the institute.

"In principle we could essentially 'print' them on to a surface and, by repeating the process a few thousands of times, obtain a mixture of growing cells and eventually a healthy pancreatic islet. "

Pancreas transplant

These insulin-producing areas of the pancreas are about 0.2mm in diameter and made of only five different types of cells, he explained.

The islets produced by the printing process would then be transplanted into the pancreas of a Type 1 diabetic patient. The hope is that they will develop there and eventually help with the regulation of blood sugar levels.

"It is a futuristic prospect, but it is not science fiction," Prof Barry said.

"We are talking five years down the line for potential clinical trials."

In the experiment, the drops containing a single stem cell were easily identified and isolated. The cells were then allowed to replicate themselves into exact copies. Finally the researchers checked that they had remained viable and unaffected by the process.

'A matter of minutes'

"Isolating stem cells one from another is difficult, costly and takes several hours in general," said Prof Barry. "Here it was done in a matter of minutes, in a very efficient way."

He reckons no other stem cell technology currently on the market is as accurate as that provided by the Poly-Pico dispensers.

Patented

The disposable cartridges are patented by Poly-Pico, a University of Limerick spin-out company now based in Galway. The cartridges are funnel-shaped, with an exit nozzle so small in diameter that it would not let a human hair pass through.

Since the typical size of a bone marrow stem cell is comparable to that of the nozzle, a drop coming out of the cartridge contains at most one cell. "By aiming sound waves at the end of the nozzle, we were able to swipe off one drop at a time," said Dr Gabriel Leen, a senior researcher at the University of Limerick and at Poly-Pico.