Another dimension: 3-D cell growth opens new pathway for spinal cord repair

October 20 2015

Griffith University Ph.D. student Mr. Raja Vadivelu is shown at work in the lab at the Eskitis Institute for Drug Discovery. Credit: Griffith University

Griffith University researchers have opened a new avenue to advance a therapy to repair the paralysed spinal cord.

A paper published in the prestigious Nature group journal *Scientific Reports* presents a novel technique to grow cells in three dimensions, without the traditional restrictions of matrix or scaffolds.

By using floating liquid marbles, cells can freely associate and form natural structures as they would normally within the human body.

"Allowing cells to grow in this 3D format dramatically increases their growth and function and is particularly useful for spinal transplantation repair in which cells are transplanted into the injury site," says research supervisor Dr James St John, from Griffith's Eskitis Institute for Drug Discovery.

The technique was developed when neurobiology merged with microfluidic engineering technology. Lead researcher, Griffith PhD student Mr Raja Vadivelu, and Professor Nam-Trung Nguyen (Queensland Micro- and Nanotechnology Centre) collaborated with Dr Jenny Ekberg (Queensland University of Technology) and scientists in Spain.

"In Australia, more than 12,000 people live with spinal cord paralysis and there is at least one new occurrence every day," says Dr St John.

"Although rehabilitation medicine has resulted in reductions in mortality, the current outcome for patients is permanent paralysis, with an overall cost to the community of $2 billion a year.

"In light of the overwhelming impact of spinal cord injury, new therapeutic interventions for drug discovery and cell therapy are urgently needed."

The transplantation of the specialised cell type from the olfactory (sense of smell) system is a promising approach to spinal cord repair.

"Successful partial regeneration of a completely severed spinal cord in a human was achieved recently in an overseas study, thus demonstrating this therapy can work," says Mr Vadivelu.

"What is now needed is to make the transplantation therapy more effective and suitable for patients with a range of different spinal cord injuries."

The new method enables transplanted cells to survive and better integrate into the injury site. In turn, this will help the spinal cord to regenerate more effectively.

"Liquid marbles are a remarkably simply way to culture cells in 3D," says Dr St John.

"A droplet of liquid that contains the cells is placed upon a carpet of teflon powder to create a liquid marble which can then be floated on cell culture medium.

"By having an air interface between the liquid marble and the cell culture medium upon which it floats, the liquid marble easily rotates.

"This allows the cells within the liquid marbles to freely associate to form natural structures without the confines imposed upon them by other 3D culturing methods."

Floating liquid marbles have been known for almost 200 years. In 1830, British explorer Alexander Burnes was travelling through what is now Pakistan when he observed the Indus River merging with the sea.

He noted that "round globules filled with water" floated on the seawater and formed when the freshwater detached sand from the sand banks.

"Burnes probably didn't think they could be used to help develop a therapy for spinal cord repair, but combining neurobiology and engineering at Griffith University has at last found an incredible use for the 'round globules'," says Dr St John.

The floating liquid marble technique can also be used to grow many other cell types in 3D and is likely to bring dramatic advances in several biological fields.

More information: *Scientific Reports*, www.nature.com/articles/srep15083

Provided by Griffith University