Lasers light the path of neuron regeneration

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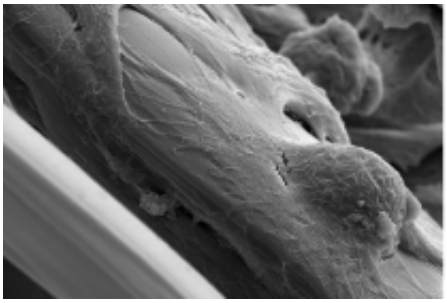

Scaffold with regenerated cells

(Medical Xpress) -- Lasers have been used to fabricate tiny scaffolds to be used as delivery vehicles to drop cells off at damaged locations and help treat diseases such as Alzheimer's and Parkinson's.

Owing to the versatility and accuracy of lasers, the structures have shown significant potential for facilitating the growth of cells and could be designed specifically to meet the individual needs of a variety of cells.

In their study published today, Tuesday 20 September, in IOP Publishing's journal *Biofabrication*, researchers used lasers to create intricate scaffolds, with features one thousand times smaller than a millimetre, and demonstrated their ability to effectively harness the growth of neuronal cells.

The repairing of neural tissue – for example peripheral nerves, spinal cord and the brain – has long been investigated using a technique known

as tissue engineering and is now becoming a realistic treatment as technology advances.

A multidisciplinary field in which tissues and organs are formed by growing cells onto materials outside of the body, tissue engineering relies heavily on the creation of scaffolds which determine the efficiency, size, shape and orientation of cell growth.

By fine-tuning the make-up and design of these scaffolds, they could be used as a delivery vehicle to drop cells off at a specific damaged location, help them attach and grow, and then become degraded in the body without any damage to the cells or the host.

In this study, the researchers, from the University of Crete and the University of Sheffield, fabricated a scaffold from a commonly used polymer, polylactic acid (PLA). This synthetic, biocompatible material degrades in the human body to form lactic acid, a naturally occurring chemical that can easily be removed, leaving the regenerated tissue behind in the required size, shape and structure.

An ultra-fast, titanium sapphire laser was tightly focused on the PLA material and moved through three dimensions to create complicated sub-micrometer structures. Within the structures, small struts and holes were fabricated to ensure stability and the efficient delivery of nutrients to the cells; both are essential for tissue generation.

Taking the fabrication one step further, 3D sea-shell structures were created from the polymer to demonstrate the intricacy of the laser technique.

To test the compatibility of the structures, the researchers grew neuronal cells on them and observed, using high powered microscopes, how the cells proliferated and aligned.

The neuronal cells showed good compatibility with the PLA structures with less than 10% of the cells dying after five days.

Study co-author Professor Frederik Claeyssens said, “This is the first time we have been able to structure polylactide with such high resolution and the first time that direct laser writing has been applied to tissue engineering.

“Compared to other techniques, direct laser writing allows the scaffold to be created in a user-defined manner on the micrometer level and provides the possibility to explore the relationship between structure of, and cell growth on, the scaffold.”

An Institute of Physics spokesperson said, “The fabrication of appropriate scaffolds is a vital step in the process of tissue engineering and must be fine-tuned if treatments for Alzheimer’s and Parkinson’s are to be realised.”

More information: iopscience.iop.org/1758-5090/3/4/045005

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