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Green light on the cellular highway to spinal cord repair

Researchers have discovered the 'green light' to improve nerve cell re-growth in the quest to repair nerve damage and spinal cord injuries.

The big challenge with spinal cord injury is that the resulting scar tissue acts as a roadblock to nerves, preventing them from re-growing naturally, and causing paralysis below the injury because the signals just can't get through.

Scientists have already developed different kinds of implants or 'cellular highways' to overcome this blockage. Some implants take the form of 'channels' filled with hydrogel, a jelly-like material that mimics the cell's native environment. The challenge has been in coaxing the nerve cells to not only take the on-ramp, but to keep going.

A key signal for directing the cells has been missing – until now.

A research team across Australia and the United States has come up with a new way of using the body's natural way of encouraging growth, with growth factors, by increasing the concentration as the nerve grows, teasing it along.

The researchers wrap a protein-laden coil around the hydrogel channel. More turns on the coil correspond to a higher concentration of the growth factor along the length of the channel. This enables three dimensional control of the concentration.

The growth factor gradient acts like a traffic signal to the neurons, encouraging them to keep growing along the channel. The team showed that nerve cells grow longer and straighter through channels with such a gradient compared to channels without the gradient.

The ultimate aim of the work is to control the direction of the re-growing nerves so they will reattach to the correct nerves on the other side of the injury, resulting in regain of motor and sensory abilities in spinal cord injury patients.

Researcher Professor Gordon Wallace from the ARC Centre of Excellence for Electromaterials Science said the use of the growth factor chemical extends the distance nerves can regrow.

"This greatly improves the potential for regeneration through reconnection of severed nerves," said Professor Wallace.

Co-author Professor Mario Romero-Ortega from the University of Texas at Dallas said the growth factor gradients are crucial for guiding nerves to their targets.

"Three dimensional molecular gradients in multi-channel devices have never been achieved before," Professor Romero-Ortega said.

So promising is this technology that is has already been patented and licensed to a Texan tissue engineering company, Tissue Gen Inc.

"We are hopeful that a commercial product will be realised in the near future," Professor Wallace said.

The work has been accepted in *Brain Research*. The topic of nerve repair will be discussed at the Electromaterials Science Symposium to be held at the University of Wollongong on 11-13 February 2015.

About the International Electromaterials Science Symposium

Hosted by the ARC Centre of Excellence for Electromaterials Science at the University of Wollongong, this symposium brings together leading researchers engaged in ground-breaking materials science. Applications that will be presented include solar and hydro-energy generation, printing 3D structures, building ultra-strong electrolyte gels and muscle regeneration through electrical stimulation of cells.

About the ARC Centre of Excellence for Electromaterials Science (ACES)

The ARC Centre of Excellence for Electromaterials Science is a global leader in advanced materials and integrated device development. Encompassing researchers, clinicians and industry partners worldwide, ACES is uniquely positioned to translate materials research into innovative next-generation solutions for clean energy and medical bionics.

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