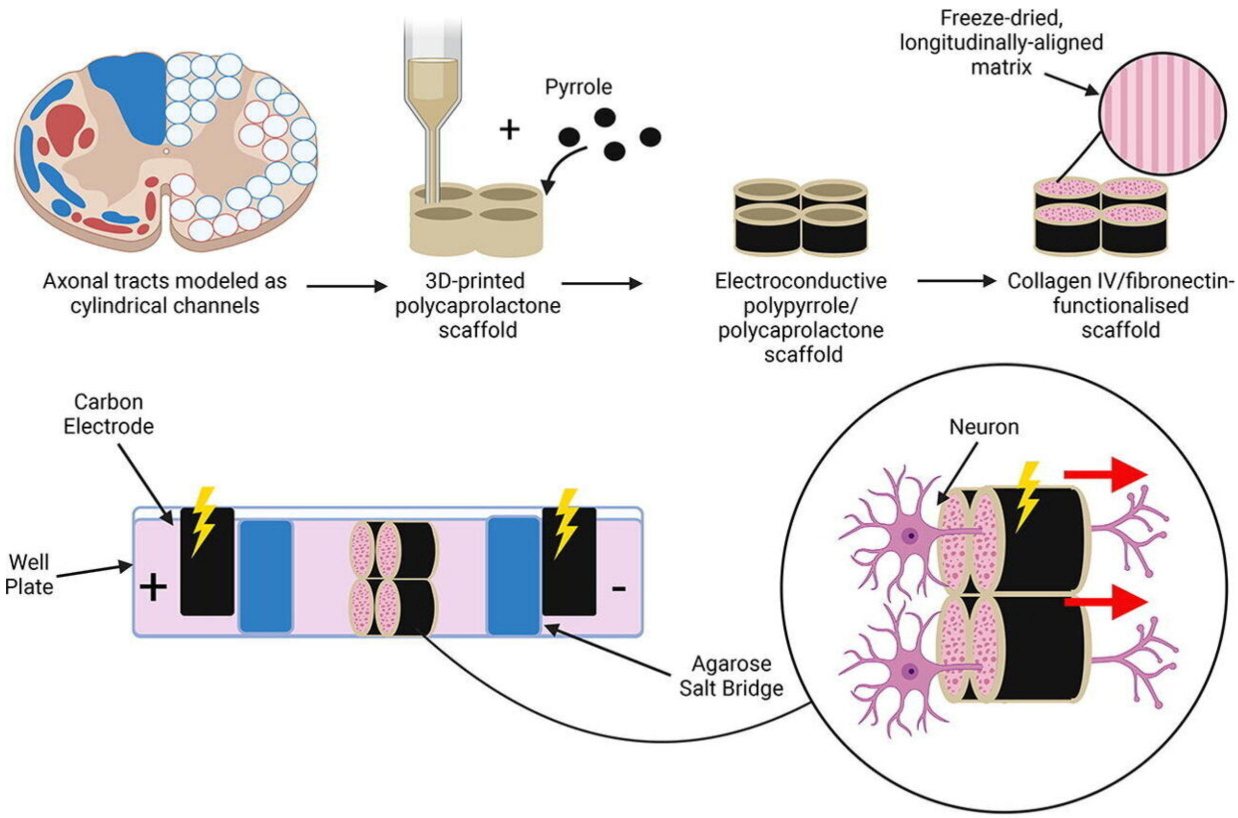
Researchers develop new implant to power healing after spinal cord injury

August 28 2024



Graphical abstract. Credit: *Materials Today* (2024). DOI: 10.1016/j.mattod.2024.07.015

A research team at RCSI University of Medicine and Health Sciences has developed a new implant that conveys electrical signals and may have the potential to encourage nerve cell (neuron) repair after spinal cord injury.

Details of the implant and how it performs in lab experiments have been published in the journal *Materials Today*.

"To date, it has been extremely difficult to promote the regrowth of neurons after spinal cord injury, which is a major obstacle in the development of successful treatments for such debilitating injuries," explains Professor Fergal O'Brien, Deputy Vice Chancelllor for Research and Innovation and Professor of Bioengineering and Regenerative Medicine at RCSI and Head of RCSI's Tissue Engineering Research Group (TERG).

"Our research here represents a promising new approach which may have potential for the treatment of spinal cord injuries."

Spinal cord injury is a devastating and often paralyzing condition. One person suffers a spinal cord injury every week in Ireland, and there are over 2,300 individuals and families living with spinal cord injury across Ireland. After injury, the long axonal projections of nerve cells are cut and "die-back" from the injury site, and at the same time, a lesion or gap forms at the wound site that prevents their regrowth necessary to restore function.

To address this complex problem, the research team at RCSI's TERG and the SFI Advanced Materials and Bioengineering Research (AMBER) Center at Trinity College Dublin developed an implantable, electroconductive 3D-printed scaffold that can be placed directly into the injury site, bridging the gap.

Professor O'Brien, who is also Deputy Director of AMBER, sees the implant as a new approach. "Bridging the lesion with an electroconductive biomaterial designed to mimic the structure of the spinal cord, combined with the application of electrical stimulation, may help injured neurons regrow their axons and reconnect to restore function," he said, adding that "No such platform exists to date."

When electrical stimulation is applied to the implant, it can convey that electrical signal to boost the regrowth of the injured axons. At the same time, the scaffolding and channels of the implant are designed to act as a bridge and direct the axons grow back in the correct formation.

When the researchers put the implant to the test in the lab, they saw promising results.

"We could see that when we applied electrical stimulation for a week to neurons growing on this scaffold, they developed long healthy extensions called neurites. In the body, this kind of growth would be a key step towards repair and recovery after an injury," said Liam Leahy, first author of the study and a Ph.D. candidate at RCSI.

The RCSI and AMBER researchers teamed up with the Irish Rugby Football Union Charitable Trust (IRFU-CT) on the project and brought together a spinal cord injury advisory group to oversee and guide the research. That group included clinicians, individuals living with spinal cord injury and Public and Patient Involvement (PPI) researchers.

"This advisory group provided valuable insight into the realities of spinal cord injuries and potential treatment strategies," says Leahy. "Through regular meetings as well as laboratory visits, the advisory group helped guide the work from its inception to the current publication and led to two separate publications on the role of Public and Patient Involvement in preclinical research."

More information: Liam M. Leahy et al, Electrostimulation via a 3D-

printed, biomimetic, neurotrophic, electroconductive scaffold for the promotion of axonal regrowth after spinal cord injury, *Materials Today* (2024). DOI: 10.1016/j.mattod.2024.07.015

Provided by RCSI University of Medicine and Health Sciences