Acadamh Ríoga na hÉireann
Royal Irish Academy

# Charlemont grant report

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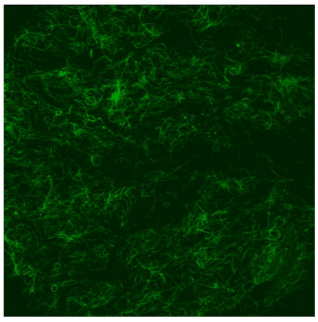
| Recipient name: | Dr. Ian Woods |
| Discipline and subject area: | Sciences |
| Amount and year awarded: | €2,500. in 2023 |
| Title of project: | ElecTrophINK: An electroconductive biomimetic hydrogel system for SCI repair applications. |

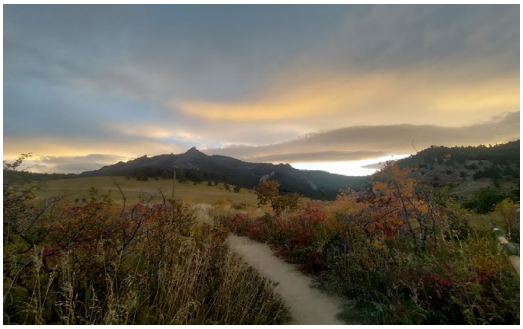
**Summary of findings:**

The main goal of the Charlemont funded secondment to the Burdick Group in University of Colorado (CU) was the production of a conductive gel material containing orientate nanofibers combining for 3D printing conductive scaffolds for spinal cord injury repair. Fractionated fibres were produced from electrospun nanofibre meshes and embedded within hydrogels to produce fibrillar bioinks. The bioinks were subsequently 3D printed in a manner that aligns the fibres. Work is ongoing within the RCSI to successfully coat the fibres with conductive nanomaterials to produce a conductive composite material through which to deliver pro-regenerative electrical stimulation.

This material may possess the characteristics necessary to safely and effectively deliver electrical stimulation to promote the regrowth of the damaged spinal cord tissue. The materials are still undergoing development (the secondment finished in November 2023) and will be examined for patentability and commercialisation opportunities with the aim of bringing an electroactive 3D printed implant towards clinical translation.



*Fibrillar hydrogel compressed*



*Colorado landscape*

**Plans for continuing collaboration:**

Professor Burdick is a named collaborator on an ERC Starting Grant to develop novel injectable fibrous materials for treating neurotrauma and will be a collaborator on an SFI Pathways application. These applications have greatly benefitted from Prof. Burdick's input and training provided by his group in the development of composite hydrogel materials.

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**Additional collaborations:**

The Charlemont Grant enabled a collaborative secondment with Prof. Jason Burdick, one of the world leaders in the field of natural polymer biomaterials. By combining my ongoing work on conductive nanomaterials with his work in fibrillar hydrogel design, we have taken the first steps towards developing a new 3D printing technique for producing conductive implants for spinal cord injury repair. This project also involved collaboration with Prof. Valeria Nicolosi, from Trinity College Dublin, who provided the nanomaterials used in the project.

**Publications associated with this project that you have been involved in:**

I plan to publish two publications using the initial data and approaches developed as part of the collaboration. The first will be a novel conductive nanofibre-containing bioink for 3D printing spinal cord implants. The second will involve the design of injectable conductive granular systems for traumatic brain injury repair. Furthermore, several other publications will be planned should associated funding applications be successful. These publications will target top quartile high impact journals and if successfully co-authored with collaborators such as Prof. Burdick and Prof. Nicolosi, should successfully garner high citation rates.

**Dissemination and plans for future dissemination:**

The findings and future work that utilises the training provided at CU will be presented at top international conferences once the associated publications are finalised. It is envisioned that top biomaterials conferences such as the European Society of Biomaterials 2025 (Zurich, Switzerland), TERMIS EU 2025 (Freiburg, Germany) and MRS 2024 (Boston, US) would be excellent opportunities to disseminate the acquired data.

**Outreach and engagement activities:**

This work will be reported to the IRFU Charitable Trust and SFI-AMBER Public Patient Involvement Group to maximise the dissemination of the scientific work to key stakeholders in the process such as patients and clinicians. No media coverage has been given to the project since the completion of the Charlemont Grant, but RCSI gives special emphasis to our highly successful PPI programme and such coverage will be forthcoming.