HORIZON 2020

Biofunctionalised Electroconducting Microfibres for the Treatment of Spinal Cord Injury

Sprawozdania

Informacje na temat projektu

Neurofibres

Identyfikator umowy o grant: 732344

Strona internetowa projektu

DOI
10.3030/732344

Projekt został zamknięty

Data podpisania przez KE
27 Października 2016

Data rozpoczęcia
1 Stycznia 2017

Data zakończenia
30 Czerwca 2021

Finansowanie w ramach
EXCELLENT SCIENCE - Future and Emerging Technologies (FET)

Koszt całkowity
€ 5 888 491,25

Wkład UE
€ 5 094 120,00

Koordynowany przez
SERVICIO DE SALUD DE CASTILLA LA MANCHA
Spain

Periodic Reporting for period 3 - Neurofibres (Biofunctionalised Electroconducting Microfibres for the Treatment of Spinal Cord Injury)

Okres sprawozdawczy: 2019-07-01 do 2021-06-30

Podsumowanie kontekstu i ogólnych celów projektu

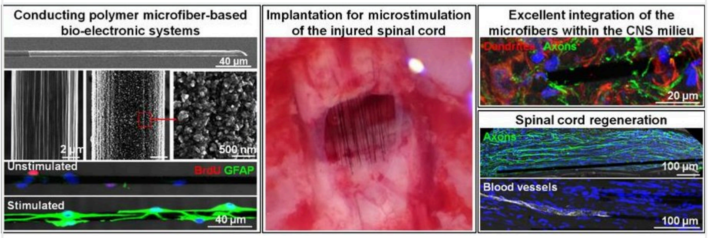
Bio-electrical scaffolds hold promise for repairing the damaged central nervous system (CNS). However, this potential has not been developed because their implantation inflicts additional neural injury, and ensuing inflammation and fibrosis compromise device functionality. In Neurofibres we want to achieve a breakthrough in “Neuroregenerative Bio-electronics”, developing dual-function devices that will serve as electroactive scaffolds for CNS regeneration and neural circuit activation. We engineered electroconducting microfibres (MFs) that add negligible tissue insult while promoting guided cell migration and axonal regeneration in rodents with spinal cord injury (SCI). The MFs also meet the challenge of probe miniaturisation and biofunctionalisation for ultrasensitive recording and stimulation of neural activity. An interdisciplinary consortium composed of neuroscientists, medical specialists, researchers in biomaterials, protein engineering, physics, and electrical and mechanical engineering, together with a company specialised in fabrication of microcables and microconnectors, will join efforts to design, develop, and test the MFs and complementary technology (microfibre functionalisation and electrical interconnection), in order to produce a biologically safe and effective bio-electrical system for the treatment of SCI.

Prace wykonane od początku projektu do końca okresu sprawozdawczego oraz najważniejsze dotychczasowe rezultaty

The work carried out has provided fundamental advances to accomplish the objectives of the project. From a technical point of view, the project was founded on developing microfibres (MFs) with improved mechanical and electrical properties (WP-1), and electrical interconnection (WP-2). Because mechanical mismatching between the interconnected MFs and the neural tissue, or breaking of the MFs, may lead to complete failure of the proposed therapeutic approach, WP-3 dealt with the mechanical features of the MFs and the MF/tissue interplay. Biomolecules at the MF surface strongly influence cell responses to the MFs. Therefore, WP-4 developed affibodies for MF functionalisation. The added effort of WPs 1, 2, 3, and 4 generated a MF-based electroconductive scaffold suitable for implantation and electrostimulation of the spinal cord. Cellular responses to the isolated components and the connected system were investigated in transgenic mice in WP-5 and 6; whereas the sensory and motor effects of the active bio-electrical system were assessed in rats and pigs in WP-7.
The work plan and the objectives of the project were extremely challenging and multiple technical difficulties arose. The novel and risky approach followed in Neurofibres faced challenging problems associated to the implant of electrodes in regions of open central nervous system trauma. Nevertheless, the consortium was able to navigate those difficulties and developed the basic tools needed and the experiments proposed. Graphene-coated carbon MFs, affibodies, interconnected carbon MF assemblies, and epidural electrodes were produced and were comprehensively tested in rodent and/or porcine models of SCI. Finally, we have demonstrated that the original goal of the project is feasible.The data obtained so far provide further support to the use of electroconducting microfibres for the treatment of spinal cord injury. However, we have not yet achieved functional recovery in porcine SCI. Additional strategies, including the combination of the electroactive implant with other therapeutic strategies are under exploration to guarantee that the new technologies find the pathway towards clinical application.

Innowacyjność oraz oczekiwany potencjalny wpływ (w tym dotychczasowe znaczenie społeczno-gospodarcze i szersze implikacje społeczne projektu)

Neurofibres combines new technologies from the sectors of bioengineering, biomaterials, biotechnology, and electroactive devices, in an innovative bio-electrical system for the treatment of SCI. The project contributed solid advances in regenerative bioelectricity, which will make possible the modulation of neural regeneration through electroactive microfibres implanted in the lesion site. Although the implantation of the proposed system will present some surgical risks for the patients, the therapeutic approach faces the complexity and intractability of the targeted pathology. Persons with SCI suffer from a multisystemic condition and presently need numerous and expensive healthcare interventions. The proposal contributed information essential for developing devices that may improve the functional status and hence the quality of life of these patients. Neurofibres developed a viable therapeutic concept that will reach clinical application in SCI and likely in other neurological diseases. Besides its future impact on the SCI population, it is opportune to remark that Neurofibres will contribute to boost the growth of the European technology sector in the field of bio-electrical scaffolds, structuring a multidisciplinary community of researchers and stakeholders in this field to provide a functional medical solution to restorative neurology.



Neurofibres

Ostatnia aktualizacja: 11 Lutego 2022

Permalink: https://cordis.europa.eu/project/id/732344/reporting/pl