Department of Biomedical Engineering

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Interfacing with the peripheral nervous system using flexible implantable bioelectronics

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Abstract

The peripheral nervous system is a crucial organ, forming the bridge of communication between the brain and the rest of the body. Implantable devices interfacing with this part of the nervous system hold great potential for the development of treatments for a wide range of clinical conditions, whether by recording electrical activity carried by nerves, or influencing it through electrical stimulation. However, current nerve interfacing technologies lack the necessary resolution to selectively record and stimulate from nerves at the sufficient resolution and stability to enable their therapeutic use. Through the use of ultraconformable bioelectronics we have created an implantable platform capable of interfacing with nerves with a resolution and stability beyond what current technologies allow. Applying this technology to nerves around the body allows us to record, classify, and modulate activity of a variety of organs including limbs, bladder, and bowel in anaesthetised and freely-moving animal models. The developed implantable bioelectronic technology represents a platform enabling new forms of fine nerve signal sensing and modulation, with therapeutic applications in conditions such as spinal cord injury and chronic pain.

Biography

Alejandro Carnicer Lombarte is a Senior Research Associate at the University of Cambridge, Department of Engineering. He received his BA in Biological Natural Sciences from the University of Cambridge (2013), MSc in Neuroscience from University College London (2014), BEng in Engineering from the Open University (2022), and PhD in Clinical Neurosciences from the University of Cambridge (2018).

Alejandro's research focuses on the development of new implantable technologies to interface with the peripheral nervous system. As an MRC Scholar during his doctoral training, Alejandro studied the link between implant mechanics and foreign body reaction. In his postdoctoral work, he employs advances in materials and microfabrication techniques to develop novel nerve interfaces, applying them for the study and restoration of function in rodent and large animal models.

Alejandro's work at the interface between biology and technology has been recognised and supported by awards such as the Wellcome Trust ISSF Postdoctoral Research Fellowship (2019), the University of Cambridge Borysiewicz Interdisciplinary Fellowship (2022), and the Institution of Engineering and Technology healthcare technology J.A. Lodge Award (2023).