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Researcher advances understanding of how the nervous system controls organs

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An international team of researchers, led by University of Houston Cullen Endowed Professor of biomedical engineering Mario Romero-Ortega, has progressed electroceutical research for treatment of diseases

including rheumatoid arthritis, colitis and sepsis. Romero-Ortega partnered with the ARC Centre of Excellence for Electromaterials Science (ACES) at the University of Wollongong in Australia.

The field of electroceuticals, where electrical stimulation is used to modify biological functions, has the potential to treat medical conditions with minimal invasion and side effects.

Published in the Nature journal of *Communications Biology*, the work builds on previous studies when the team introduced the sutrode to the world just over a year ago. This graphene-based electrode is an electrical stimulation device that could replace the use of pharmaceuticals to treat a range of medical conditions. The sutrode, created using the fabrication technique known as fiber wet spinning, combines the electrical properties of an electrode with the mechanical properties of a suture.

"The flexibility and superb sensitivity of the sutrode is allowing us to expand our understanding of how the nervous system controls main body organs, a critical step towards developing advanced therapies in bioelectronic medicines," reports Romero-Ortega. "Our collaborative work uncovered that the spleen is controlled by different terminal nerves, and that the sutrode can be used to control them, increasing the precision in which the function of this organ can be modulated."

ACES director professor Gordon Wallace, a co-author on the paper, said the sutrode can be integrated with delicate neural systems to monitor neural activity.

"This work has widespread implications for regulating the function of the spleen, particularly the efficient regulation of the immune response for electroceutical treatment of range of diseases," said Wallace. "We have highlighted the ongoing need to develop systems with increased fidelity and spatial resolution. This will not only bring practical

applications to the forefront but will enable the unattainable exploration of the human neural system."

The work also reveals the ability to simultaneously interrogate the four individual neural inputs into the spleen. This new technical and biological achievement will not only bring about practical applications, but also enable a previously unattainable exploration of the human neural system.

More information: Maria A. Gonzalez-Gonzalez et al, Platinized graphene fiber electrodes uncover direct spleen-vagus communication, *Communications Biology* (2021). DOI: 10.1038/s42003-021-02628-7

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