Breakthrough bioelectronic medicine discovery made by decoding immune system's neural signals

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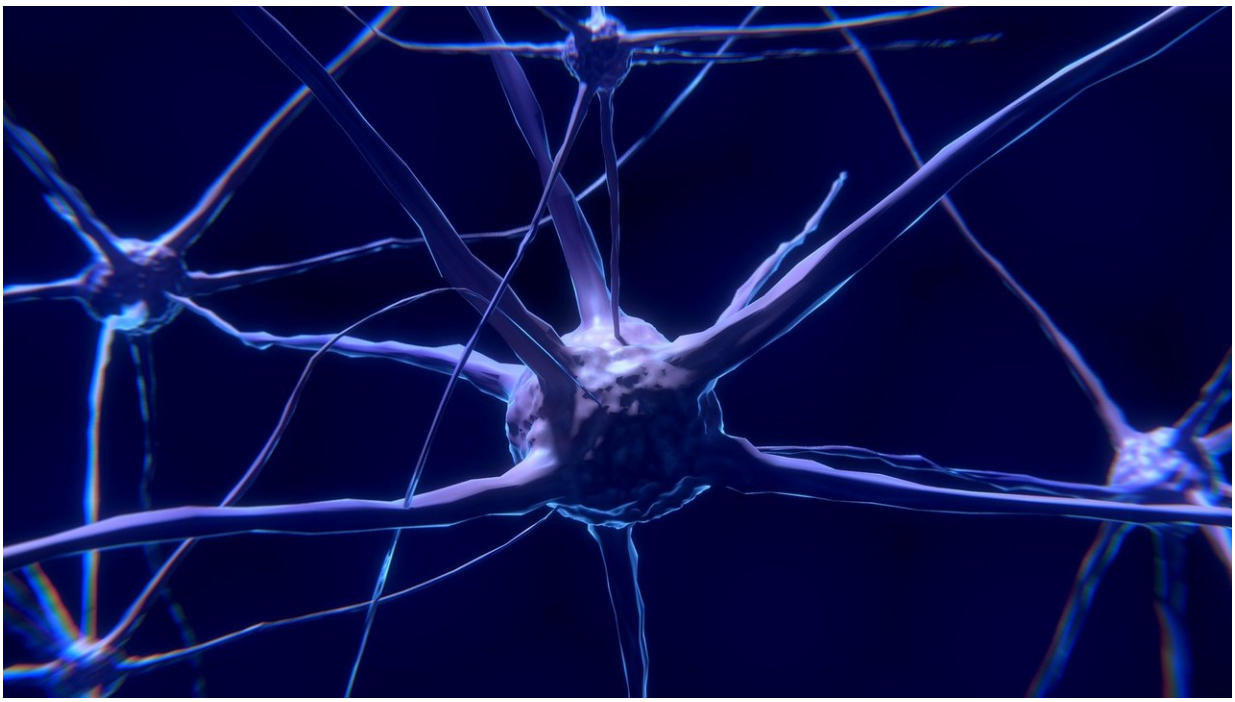

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Northwell Health's Feinstein Institute for Medical Research Assistant Professor Theodoros P. Zanos, PhD, and his collaborators are the first to decode specific signals the nervous system uses to communicate immune status and inflammation to the brain. Identifying these neural signals and

what they're communicating about the body's health is a major step forward for bioelectronic medicine as it provides insight into diagnostic and therapeutic targets, and device development. These findings were published today in *Proceedings of the National Academy of Sciences* (*PNAS*).

It was already known that the vagus nerve, a nerve in the neck, controls the release of molecules called cytokines, which promote inflammation in many disease conditions. However, up until now, it was unknown if each type of cytokine was sending its own specific information about inflammation and immunity to the brain. In Dr. Zanos' study, he successfully decoded the neural signaling of two cytokines - IL-1β and TNF - in the vagus nerve of mice and found that each cytokine triggered their own specific response signal.

"These results show that it is possible to detect specific cytokine signaling from the body's receptors to the brain, through electrical signals in the vagus nerve," said Dr. Zanos, lead author of the *PNAS* paper. "We will now use the neural decoding methods from this study to identify the neural signaling of a variety of medical conditions in future bioelectronic medicine studies. This is a key step to provide insights to engineer cutting-edge diagnostic and therapeutic devices."

Bioelectronic medicine is an emerging field of medicine which combines neuroscience, molecular biology and bioengineering to tap into the nervous system to treat disease and injury without the use of pharmaceuticals. Conditions identified as benefitting from bioelectronic medicine therapies include rheumatoid arthritis, Crohn's disease, diabetes, paralysis and lupus.

"Dr. Zanos' findings are a major discovery in the field of bioelectronic medicine," said Kevin J. Tracey, MD, president and CEO of the Feinstein Institute. "We have long known that the nervous system

communicates with the body. We can now learn the language by which it communicates, which enables us to fine tune how we help the body heal itself."

More information: Theodoros P. Zanos el al., "Identification of cytokine-specific sensory neural signals by decoding murine vagus nerve activity," *PNAS* (2018). www.pnas.org/cgi/doi/10.1073/pnas.1719083115

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