

SIMPEL: ELECTRODE DEVICE TO SAFELY AND PRECISELY STIMULATE SYMPATHETIC NERVES TO TREAT ASTHMA, HYPERTENSION AND OTHER CONDITIONS

[Cloonan, Paige](#), [Kamath, Ashwin](#), [Leuthardt, Eric](#), [MacEwan, Matthew](#), [Moore, Amy](#), [Moran, Daniel](#), [Qin, Yidan \(Ida\)](#), [Ray, Wilson](#), [Zhang, Christopher](#)

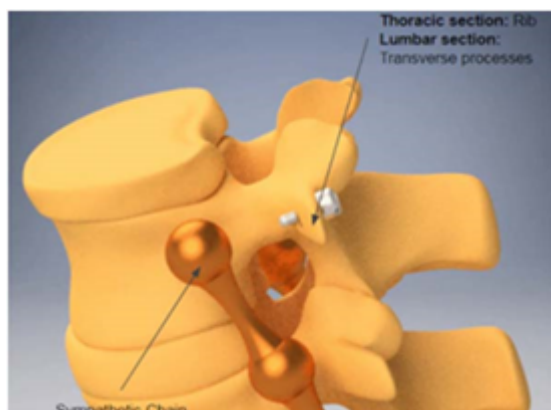
[Weilbaecher, Craig](#)

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Technology Description

A team of researchers at Washington University have developed “SIMPEL”, a small, implanted electrode device designed to manage a variety of conditions (such as asthma, hypertension or neuropathy) by delivering current from a defined, fixed position near specific sympathetic nerves.

Currently, electrical stimulation can successfully treat epilepsy by targeting the parasympathetic nervous system. Adapting this approach for the sympathetic chain could potentially regulate unwanted stress response (e.g., increased blood flow, accelerated respiration, increased perspiration) that leads to conditions such as hypertension, asthma or hyperhidrosis. To do so, the electrode must be precisely positioned to stimulate or inhibit selective locations without damaging the nerve. SIMPEL achieves this with a screw-shaped electrode that is anchored to the bone in close proximity to the nerve (~4 mm away). This prevents the electrode from migrating away from the target location and protects the nerve because there is no direct contact. SIMPEL has a universal design such that the same device can be used on a variety of conditions because its location determines which organ it effects and therefore which disease it treats. Also, SIMPEL can be manufactured in a variety of sizes/dimensions to accommodate placement in different types of bone locations (transverse process, ribs or both).



Schematic of SIMPEL: The screw electrode is fixed to the transverse section of the vertebra in close proximity to the sympathetic chain to provide stimulation or inhibition without direct contact.

Stage of Research

The inventors have fabricated a prototype screw electrode and tested it in a rat model. They were able to stimulate the sciatic nerve from 4mm away with a 10mA current and the nerve responded differently depending on the frequency of stimulation.

Applications

- **Medical device** to manage disorders associated with the sympathetic nervous system, with specific conditions determined by the position of the electrode, for example:
 - **asthma** could be treated by stimulating the T1-T5 region
 - **hypertension and hyperhidrosis** could be treated by inhibiting the T1-T4 region
 - **gastrointestinal diseases** could be treated by inhibiting the T9-L3 region
 - **overactive bladder** could be treated by inhibiting the L1-L2 region
 - the device could potentially be adapted to treat **neuropathy/neuropathic pain**

Key Advantages

- **Universal design** for different locations, conditions and patients:
 - adapts to multiple disease states – the position of the device determines whether which disease is being treated by either exciting or inhibiting the sympathetic activity
 - small implantable electrode and power source
 - array of sizes/dimensions (4 mm to 22 mm) to treat different locations without additional work for the surgeon (doesn't need to be tailored to each patient)
- **Precise, localized, safe electrical current:**
 - electrode makes **no direct contact** with the sympathetic chain - designed to prevent damage by stimulating remotely
 - the current is targeted to a **specific location** to prevent side effects associated with stimulating the entire sympathetic chain
 - screw is attached to bone in a **fixed position** to maintain the electrical current in the desired location without migrating off-target
- **MRI-compatible** – body of electrode screw coated with TiO₂ for insulation

Patents – [Systems and methods for stimulating sympathetic nervous system](#) (U.S. Patent Application Publication No US2019/0351235 A1)

Websites

- [Leuthardt Lab](#)
- [Moran Lab](#)
- [Ray/MacEwan Lab](#)