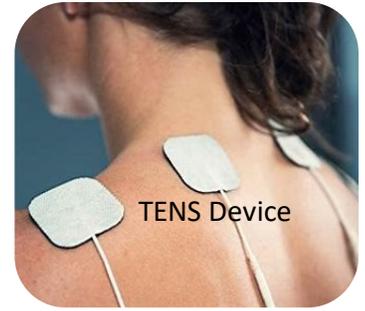


ELECTROCEUTICALS: THE BODY ELECTRIC

OCTOBER 2018 TECH BRIEF FOR LIFE
SCIENCES TALENT NETWORK



Pacemaker



TENS Device

Deep Brain Stimulation for Chronic Pain

Walt Whitman published *Leaves of Grass* in 1855, a book of poems, none of which had titles. In time, the poems were named like hymns, by their first line. One poem became, “*I Sing the Body Electric.*” Ray Bradbury wrote a short story around this idea. Later, the title became the jumping off point for [a pivotal musical number](#) in the 1980 Broadway musical “*Fame.*” Its orchestral underlay and imagery connecting an electric stage performance with stardom (figurative and literal), allowed it to endure decades after its debut.

The *body electric* is less of a metaphor now than it was 38 years ago. With implantable electronic devices like the pacemaker, [high-tech prosthetic devices](#) and non-invasive electroceutical therapeutics, the body can indeed be electrified. Make way Darth Vader, the [Michael J. Fox Foundation](#) has made electroceuticals mainstream. So has writer Michael Kinsley whose book, [Old Age, A Beginner's Guide](#), has been another beacon for Parkinson Disease (PD) sufferers.



The dramatic solution for late stage PD is called [deep brain stimulation](#). It is a neurosurgical procedure involving the implantation of a medical device called a neurostimulator (sometimes referred to as a 'brain pacemaker'), which sends electrical impulses to help overcome the movement disorder.

When different brain regions are targeted, other treatment-resistant disorders such as chronic pain (including [peripheral neuropathy](#)), severe paralysis, and obsessive-compulsive disorder can be alleviated, all or in part. Electroceutical pain management may be useful to combat the opioid crisis, at least for those who can afford the surgery.

Labor Force Takeaway

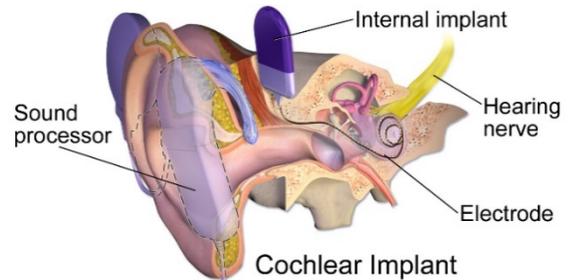
Electroceuticals testing and development is not a sector in which NJ has momentum, perhaps since it is still relatively new. However, it is an important future for the care of many with intractable chronic conditions – both mental and physical. We can expect a significant interest in this bioelectric technology especially among wealthy patients.

Pain management using electroceuticals can avoid the use of opioids and serve as an important part of opioid epidemic control. The Technology Advisory Network recommends that the use of electroceuticals be covered in upskilling classes.

Allowing the Deaf to Hear and the Blind to See

Electroceuticals, aka bioelectric medical devices, are not as new as the name might suggest. Pacemaker technology for heart stimulation dates to the early 20th century. Today's pacemaker technology is the [size of a vitamin pill](#), has battery life for a decade and is externally programmable. Since the late 1950s, technology has been allowing the deaf to "hear." More recently technology has allowed the blind to "see" and those with spinal cord injuries, the dignity of motor prosthetics for control of movement, including bowel and urinary evacuation.

[Cochlear implants](#) are used to treat those with severe hearing impairments. Neurologically, the device converts sound sensation to electric stimulation of the auditory nerve. It isn't biological hearing, but the brain adapts nonetheless. Cochlear implants have been around long enough (~50 years) for [the hearing impaired to take issue](#) with the bionic assault [on their culture](#). Yet most parents of children with congenital hearing loss opt for implants rather than sign language lessons, and [Gallaudet University](#), the Harvard of education for the deaf, is [neutral on the issue](#).



[Visual prosthetics](#) for those who are visually impaired but not fully blind [are one form of augmented reality](#). Retinal implants are on the horizon. On September 18, [Second Sight Medical Products, Inc.](#) announced it had received an \$1.6 million advance on a \$6.3 million National Institute of Health (NIH) grant to conduct clinical trials with five subjects in which cortical visual prosthesis will be implanted. The trial is expected to end in 2023.

Electroceutical pain management can avoid the use of opioids for those who are well insured.

[Neurostimulation](#) is an intrinsic part of advanced prosthetics. Even more sophisticated are the implantable devices enabling a patient with a [spinal cord lesion](#) to control their bladder and ditch the adult diapers. Neurostimulation is used as a "last resort" treatment, when surgery is not likely to help, when surgery has failed or when the levels of opioids required to manage pain are unacceptable. Those, for whom bioelectric technology is successful, consider it a new lease on life. From *I Sing the Body Electric*: "[I glory in the glow of rebirth](#), creating my own tomorrow, when I shall embody the earth."

Not all electroceuticals are as invasive or dramatic as is needed to regain sight and sound. Transcutaneous electrical nerve stimulation or "TENS devices" have been [cleared by the FDA since 2000](#). Electric currents are used to stimulate nerves within large muscles to relax tension or to relieve modest levels of stabbing pain or athletic overwork. It offers a substitute for prescription muscle relaxants.

Transcranial electrical stimulation (tES) is used on the skull and recalls electro-shock therapy. Thankfully it is a more sophisticated and efficacious cousin. It was approved by the FDA in 2015 to treat major depression.

[Leading companies in the field include:](#) Medtronic PLC, St. Jude Medical Inc., Boston Scientific Corporation, Cochlear Limited, Sonova Holding AG, LivaNova, Biotronik, Nevro Corporation, Second Sight Medical Products, ElectroCore LLC, Stimwave LLC and Vomaris Innovations Inc.