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VA research on SPINAL CORD INJURY

VA research focuses on returning motor and sensory function to Veterans with SCI. Researchers are working in the many fields, including neural engineering, wheelchairs and adaptive technology, treatment of SCI complications, and new rehabilitation methods.

ABOUT SPINAL CORD INJURY

- Spinal cord injuries (SCIs) impair the brain's ability to send messages to the rest of the body. These injuries can result in paralysis, loss of feeling, chronic pain, and other serious medical problems below the site of injury.
- SCIs are [estimated](#) to affect between 249,000 and 363,000 Americans, with about 17,730 new injuries occurring each year. About 80% of people with new injuries are male, and roughly 42,000 people with SCIs are [Veterans](#).
- Nearly half of all SCIs occur in people between the ages of 16 and 30, so many patients must live with the effects of these injuries for decades.
- VA [provides](#) care to more than 27,000 Veterans with SCIs and related disorders each year, making VA the largest health care system in the world providing lifelong spinal cord care.

VA RESEARCH ON SPINAL CORD INJURY: OVERVIEW

- VA is a member of the [Consortium for Spinal Cord Medicine](#), an organization focused on making care for persons with SCI more evidence-based. The consortium makes recommendations to health care providers based on current research findings that experts have graded for their scientific strength and validity.

- The VA [Advanced Platform Technology](#) (APT) Center focuses on the practical medical needs of Veterans disabled by problems related to the sensory or motor systems, cognitive deficits, or limb loss. Their work emphasizes prosthetics and orthotics, wireless health monitoring and maintenance, and interfaces to connect the nervous system with internal or external devices.
- VA's [Center for Functional Electrical Stimulation](#) (FES) focuses on the application of electrical currents to either generate or suppress activity in the nervous system. FES can control the movement of otherwise paralyzed limbs for standing and hand grasp and activate body functions such as bladder control and respiration.
- The [Human Research Engineering Laboratories](#) (HERL) is operated jointly by the Pittsburgh VA and the University of Pittsburgh. HERL's mission is to continually improve the mobility and function of people with disabilities through advancing engineering and clinical research in medical rehabilitation. HERL features state-of-the-art research instruments and machines for prototype fabrication.
- VA researchers are also working in the field of [regenerative medicine](#), learning how to restore tissue and organ function, including spinal cord function, lost as a result of aging, injury, or disease. They

are using a variety of tools to change the ways wounds heal in humans to enable damaged organs and tissues to repair and regenerate.

SELECTED MILESTONES AND MAJOR EVENTS

- 1988** – Established the [Center for Neuroscience and Regeneration Research](#) at the VA Connecticut Healthcare System
- 1989** – Established the [Cleveland FES Center](#) to focus on the application of electrical currents to generate or suppress activity in the nervous system
- 1994** – Established the [HERL](#) in Pittsburgh
- 2002** – Conducted, in rodent models, the first [transplant](#) of myelin-forming cells that act as insulation around spinal cord nerves
- 2005** – Established the [APT Center](#) at the Louis Stokes Cleveland VA Medical Center
- 2010** - Established the [Gordon Mansfield VA Spinal Cord Injury Collaborative Translational Consortium](#)
- 2016** – Won the Blackwood best new concept award for creation of the [MeBot](#), a wheelchair that can tackle steps, pavement edges, and rough terrain
- 2019** – [Developed](#) a system to restore respiratory muscle function to individuals

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with SCI, enabling them to effectively cough

2020 – [Invented](#) a smart bandage to aid in the healing of pressure injuries

RECENT STUDIES: SELECTED HIGHLIGHTS

- **Brief exposure to hypoxic air can improve motor function in people with SCI**, found a study by Edward Hines Jr. VA Hospital researchers. Hypoxic air is air that contains reduced oxygen levels. Researchers treated volunteers to intermittent hypoxia, interspersed with periods of breathing normal air, along with transcranial magnetic stimulation. The treatment increased electrical activity in muscles in the hand, which could help SCI patients recover lost motor function. ([Experimental Neurology](#), January 2021)
- **HERL researchers developed new designs for an adjustable wheelchair that allows users to participate in para-table tennis events.** The team found that specific support, movements, and posture needed to competitively participate in table tennis are different than general day-to-day mobility requirements. Many adaptive sports are improved with sport-specific technology. ([Disability and Rehabilitation](#), Sept. 19, 2020)
- **Neural stem cell grafts can form functional synaptic networks in the**

spinal cord, found a study by VA San Diego researchers. Researchers found stem cells grafted to the spinal cord organized into spontaneously active synaptic networks. Electrical signals from the human host were able to activate the grafted neural cells, which in turn activated nerve cells below the injury site. ([Cell Stem Cell](#), Sept. 3, 2020)

- **APT Center researchers developed an algorithm to detect sudden stops during wheelchair use.** Sudden stops can cause falls from a wheelchair, especially in paralyzed users. The team paired the algorithm with a neurostimulation device that increases trunk stability, reducing the likelihood that the user will be dislodged from the wheelchair during a sudden stop. Volunteers with SCI reported feeling safer while using the system. ([Journal of Spinal Cord Medicine](#), Aug. 14, 2020)
- **Nerve health is maintained after implanting an electrode stimulation device**, according to an APT Center study. A patient with leg paralysis was given an implanted electrode device to stimulate his leg muscles and help him to stand. One year after surgery, researchers found preserved nerve health with strengthened responses following stimulated exercise, demonstrating that implanted electrodes to restore function after SCI can be both safe and effective. ([Journal](#)

[of Neuroengineering and Rehabilitation](#), July 14, 2020)

- **Denosumab can be used to preserve bone density in patients with SCI**, found a James J. Peters VA Medical Center study. Denosumab is a monoclonal antibody drug used to treat osteoporosis, bone loss, and problems related to cancer. SCI patients who received denosumab maintained higher bone mineral density at the knee 18 months after treatment than those who received a placebo. ([JMBR Plus](#), June 25, 2020)
- **Boosting energy levels within damaged nerve fibers may help them regenerate**, according to a study by Richard L. Roudebush VA Medical Center researchers. The team found that increasing function and energy metabolism within mitochondria in mouse models is key to enabling axons to regenerate and improve recovery of function after SCI. The researchers stimulated the mitochondria by deleting a protein anchor and increasing energy metabolism through creatine treatment. ([Cell Metabolism](#), Mar. 3, 2020)

For more information on VA studies on spinal cord injury and other key topics relating to Veterans' health, please visit www.research.va.gov/topics

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