

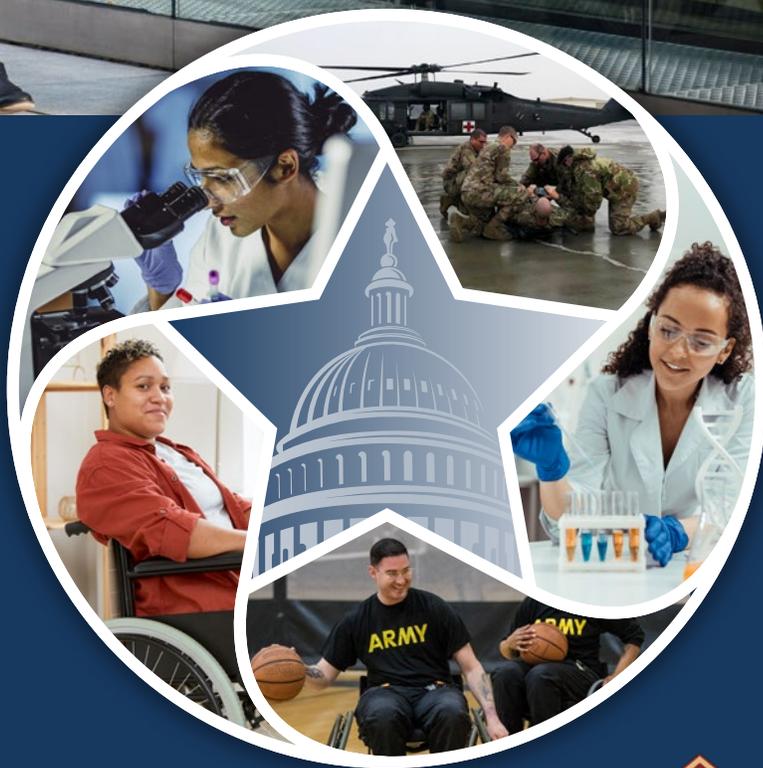
# Spinal Cord Injury Research Program



Congressionally Directed Medical  
Research Programs

# CDMRP

Department of Defense



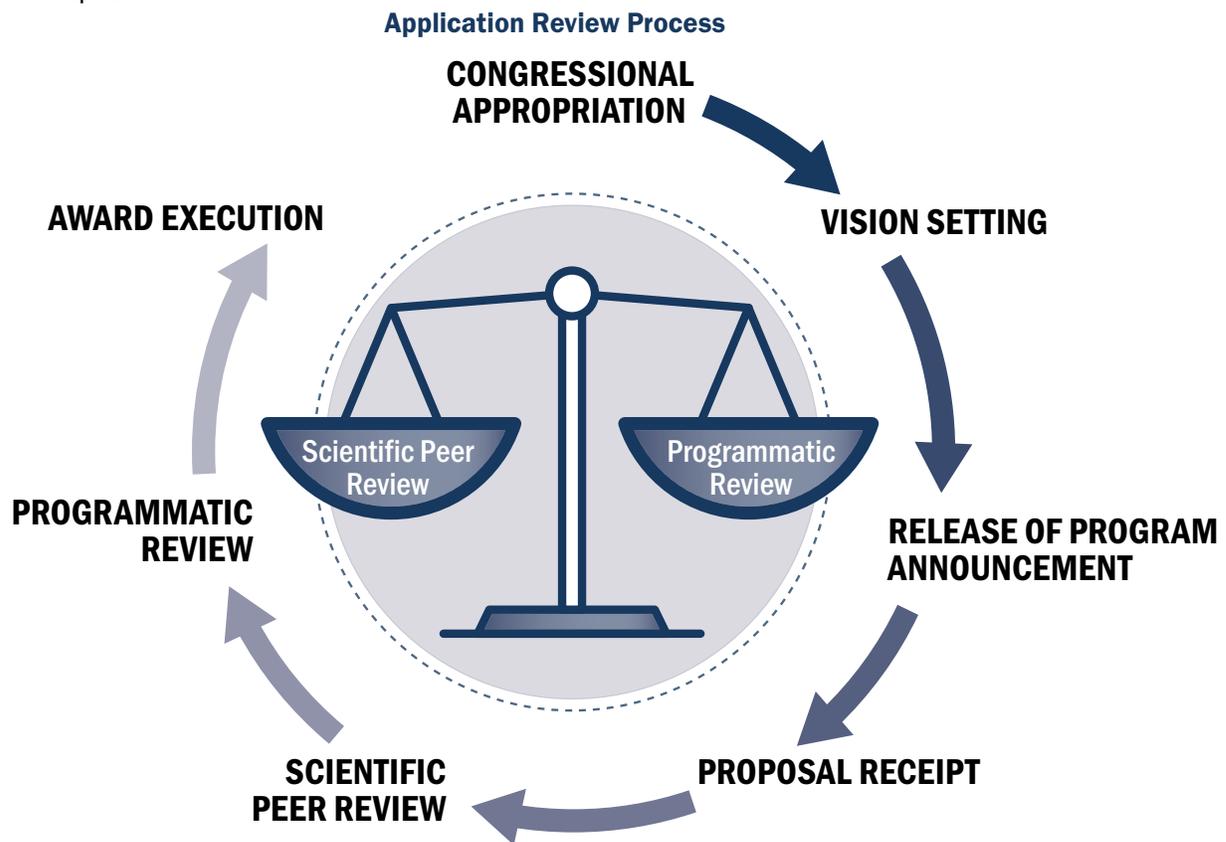
U.S. Army Medical Research  
and Development Command



# Congressionally Directed Medical Research Programs

**CDMRP History:** Though the Congressionally Directed Medical Research Programs (CDMRP) originated in 1992 with a Congressional appropriation for breast cancer research, it has grown into a global funding organization for cancer, military medical, and other disease-specific research. The CDMRP fosters novel approaches to biomedical research in response to the expressed needs of its stakeholders—the American public, the military, and Congress. It now encompasses multiple targeted programs and has received nearly \$15.9 billion in appropriations from its inception through fiscal year 2020 (FY20). Funds for the CDMRP are added to the Department of Defense (DoD) budget, in which support for individual programs such as the Spinal Cord Injury Research Program (SCIRP) is allocated via specific guidance from Congress.

**Application Review Process:** The CDMRP uses a two-tier review process, with both tiers involving dynamic interaction among scientists and people with lived experience. Scientific peer review determines the scientific merit of the application, while programmatic review compares applications and makes recommendations for funding based on potential impact, adherence to the intent of the award mechanism, relevance to program goals, and portfolio composition.



“Spinal cord injuries are complex and devastating. As a paraplegic and a layperson, it is often difficult to understand the science behind a spinal cord injury. Serving as a Peer Reviewer taught me so much, not only about my own condition, but the cutting-edge research conducted in hospitals, universities, and institutions around the world. Participating in the Spinal Cord Injury Review Panel was invigorating, educational, and more importantly, gave me the sense that I contributed to the field of science that will help others who have suffered this debilitating injury.”

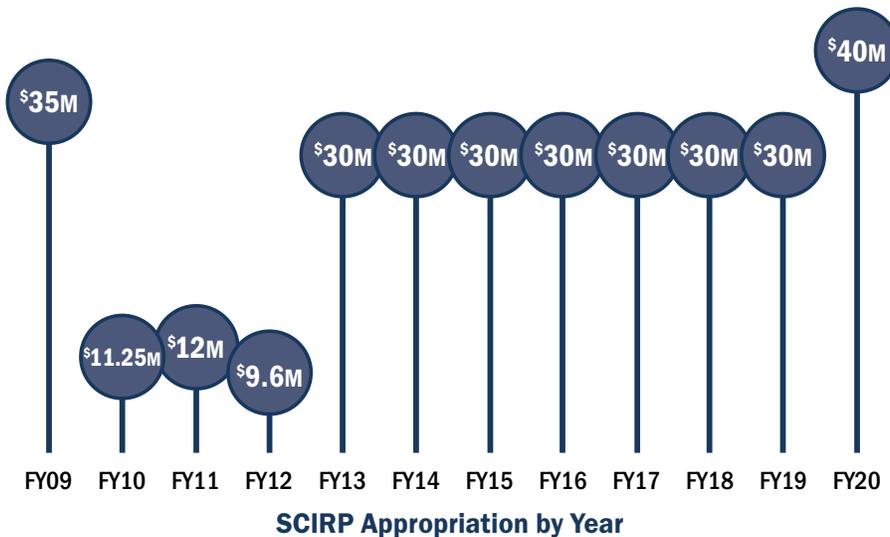
**Claudia Garofalo**  
*Consumer Peer Reviewer*

# Spinal Cord Injury Research Program

**Vision:** Advance the treatment and management of spinal cord injury and ameliorate its consequences relevant to injured Service members

**Mission:** To fund research and encourage interdisciplinary collaborations for the development and translation of more effective strategies to improve the health and well-being of Service members, Veterans, and other individuals with spinal cord injury

**History:** The Spinal Cord Injury Research Program was established by Congress in FY09 with an initial investment of \$30 million (M) to support research into repairing/regenerating damaged spinal cords and improving rehabilitation therapies. The SCIRP has continued to deliver on that mandate year after year. With \$317.9M in Congressional appropriations between FY09 and FY20, the SCIRP is now a leading funder of spinal cord injury (SCI) research in the United States and supports the development of health care solutions for both the acute and chronically injured.



**\$245M** INVESTED INTO RESEARCH (FY09-FY19)

**254** FUNDED PROJECTS (FY09-FY19)



## SCIRP Areas of Investment

The SCIRP portfolio can be partitioned into five key areas of investment demonstrating the diversity of programmatic interest into systems or problems relevant to SCI. While research into secondary health effects (e.g., pressure injuries, bladder dysfunction, pain) represents the largest area of investment for SCIRP between FY09-FY19, the whole portfolio breakdown illustrates that SCIRP is dedicated to fostering whole person health care solutions.

**\$13M**

PSYCHOSOCIAL RECOVERY

**\$18M**

ACUTE INJURY MANAGEMENT

**\$54M**

INJURY PATHOLOGY & REPAIR

**\$57M**

FUNCTIONAL RECOVERY

**\$102M**

SECONDARY HEALTH EFFECTS

Health care solutions supported by the SCIRP are targeted at various stages of injury with investment into chronic injury heavily represented.

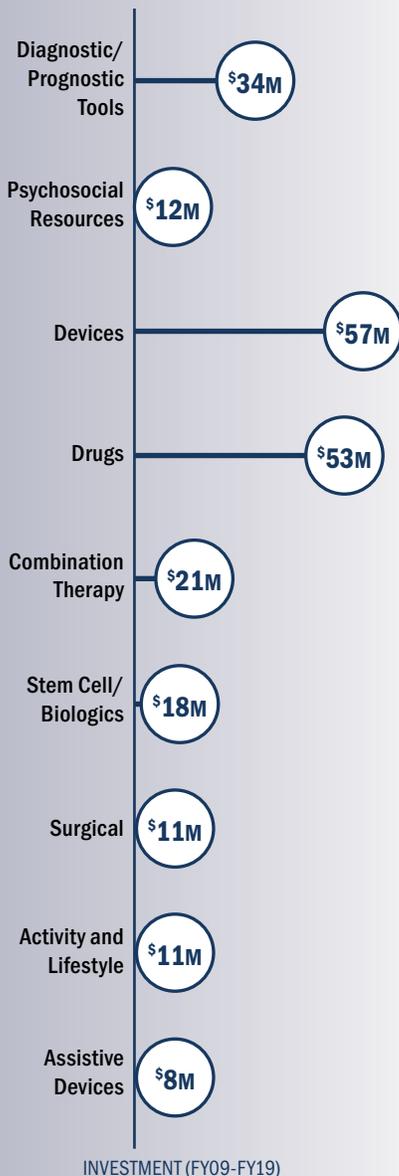
Acute Injury: \$56M

Chronic Injury: \$191M



# SCIRP Portfolio – Investment in Interventions

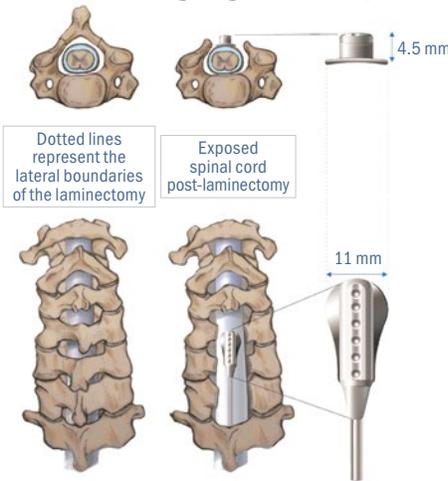
Drug and device interventions represent a large portion of the SCIRP investment portfolio. However, a number of other modalities receive a smaller yet significant investment, such as diagnostic and prognostic tools, psychosocial resources, and activity- or lifestyle-focused interventions. The SCIRP embraces the idea that a multifactorial approach to SCI treatment is necessary to improve the health and wellbeing of people living with SCI.



# SCIRP Portfolio – Focus Areas (FY18–FY20)

The SCIRP's priorities are re-evaluated annually to ensure that funded research addresses the Congressional intent of the program, consumer community needs, and gaps within the research funding landscape. To this end, the SCIRP uses focus areas to target research funding to the highest program priority needs. The current SCIRP focus areas were established in FY18 and, although the language of these focus areas has been adjusted slightly, the overall intent has stayed the same. The following are examples of SCIRP-funded products that align with the five current SCIRP focus areas and demonstrate the promising health care solutions currently under development.

## Preserving and protecting spinal cord tissue at time of injury for improved neurologic outcomes



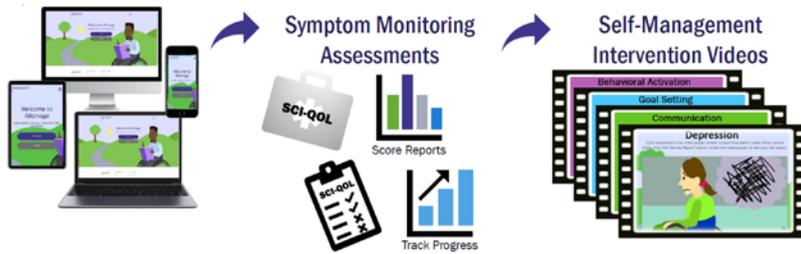
The NIRS system is a near-infrared spectroscopy sensor designed to monitor the oxygenation and hemodynamics of the spinal cord and surrounding tissue in real time immediately after an SCI. Development was supported by an FY15 SCIRP Translational Research Award.

## Rehabilitation and regeneration — maximizing the function of the residual neural circuitry, including harnessing neuroplasticity and recovery to improve function after SCI

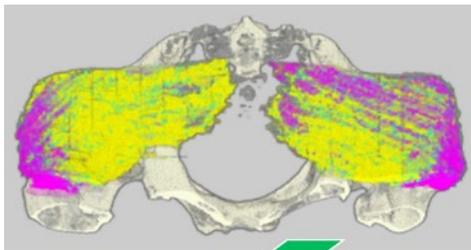


The MyndMove system is a neuromodulation device that stimulates muscle contraction to evoke a variety of reaching and grasping movements. Efficacy testing of this technology in people with tetraplegia following traumatic SCI is supported by an FY15 SCIRP Clinical Trial Award.

## Psychosocial issues relevant to people with SCI, their families, and/or their carepartners



iManage SCI, an online self-management tool to help individuals facilitate their mental wellness, is being adapted specifically for Veterans living with SCI, supported by an FY19 SCIRP Translational Research Award.



## Identifying and validating biomarkers for diagnosis, prognosis, and evaluation of treatment efficacies



The PIPCHIP device is under development to identify blood-based biomarkers for pressure injury risk in individuals living with SCI and is supported by an FY19 SCIRP Expansion Award.

## Bowel, genitourinary, cardiopulmonary dysfunction, and neuropathic pain

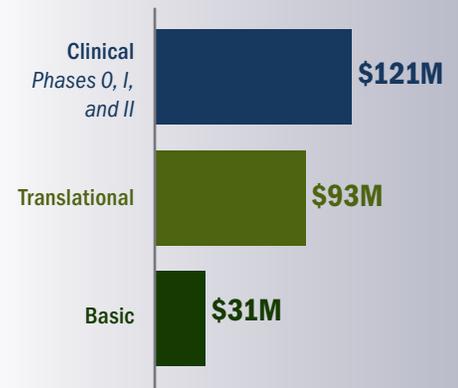


Photo Credit: Elaine Schmidt/UCLA Health

A non-invasive, transcutaneous spinal cord stimulator is under clinical evaluation for effect on neurogenic bladder symptoms. Optimal dosing for improved bladder function is supported by an FY13 SCIRP Clinical Trial Award.

## SCIRP Portfolio – Investment by Readiness

The SCIRP is investing across the research and development spectra with a focus on clinical implementation and bringing products to patients. Consistent with that goal, 49% of the SCIRP investment portfolio (FY09-FY19) is directed toward clinical research, and over 50 clinical trials are supported by SCIRP funding.



**51**  
CLINICAL  
TRIALS



**>5,000**  
STUDY  
PARTICIPANTS



**190**  
STUDY  
SITES  
ENGAGED

# Rehabilitation and Regeneration: maximizing the function of the residual neural circuitry, including harnessing neuroplasticity and recovery to improve function after SCI

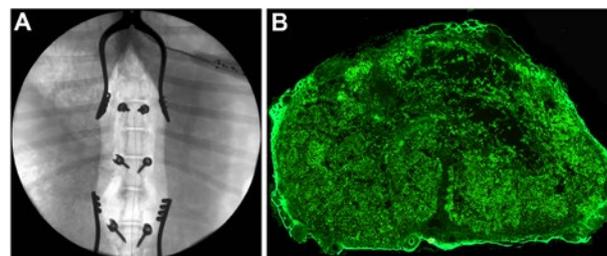
The original Congressional language provided with the first appropriation for the SCIRP noted that research into regenerating damaged spinal cords and improving rehabilitative therapies offers real promise for enhancing the long-term care of wounded Soldiers. More than 10 years later, the SCIRP remains dedicated to this effort. The following are examples of how program investment across the research and development spectrum is meeting this call.

## Therapies to increase respiratory function after SCI

A debilitating consequence of cervical SCI is a disruption of respiratory system function. Respiratory damage and diaphragmatic paralysis are huge problems immediately after SCI. Dr. Alilain and his team are testing the efficacy of bisperoxovanadium given via inhaler to repair respiratory circuits in rodent models of cervical SCI. In addition, his team is leveraging the existing drug theophylline for use in emergency settings immediately after SCI. This treatment may prevent secondary damage and reduce the need for mechanical ventilators.

*Dr. Warren Alilain, University of Kentucky*

## Treating glial scarring after SCI with a novel peptide



(A) Fluoroscopy image of the infusion catheter within the cerebrospinal fluid space close to the intended site of spinal injury in pig. (B) Biodistribution image of intrathecally injected FITC-CRP within the cord in a pig SCI model.

An innovative treatment, CSPG Reduction Peptide (CRP), infused into the injured spinal cord, is designed to reduce glial scarring. This allows new neuronal connections to form across the site of injury to help restore function after an SCI. In collaboration with the University of British Columbia, the study team is testing the efficacy of CRP in rodent and swine models of sub-acute SCI.

*Dr. Yu-Shang Lee, Cleveland Clinic*



## A multi-center trial to improve SCI rehabilitation interventions by retraining the brain

After an SCI, the brain tends to put more force into stronger muscles and less into the weakened ones affected by the injury. Targeting spared nerves with mild electrical currents from atop the skull using a safe and non-invasive method may re-establish the brain's memory of the paralyzed muscle and enhance the ability of the brain to adapt to changes. In this case, a highly qualified "team-of-teams" collaboration spanning across the Cleveland Clinic (Dr. Ela Plow), Kessler Institute (Dr. Gail Forrest), Louis Stokes Cleveland Department of Veterans Affairs (VA) Medical Center (Dr. Svetlana Pundik), and MetroHealth Cleveland (Dr. Kevin Kilgore) are testing whether this brain stimulation technique, combined with physical therapy, will improve rehabilitation outcomes. Forty-four individuals with SCI and 20 healthy control participants will be periodically assessed throughout the course of rehabilitation to determine the effectiveness of transcranial direct current stimulation (tDCS). If successful, tDCS is an inexpensive and easily administered methodology that can be added to standard rehabilitation methods to improve physical therapy for those living with SCI.

*Dr. Ela Plow, Cleveland Clinic*

## Portfolio snapshot: acute intermittent hypoxia (AIH) to restore function after SCI



**Motor**  
**\$1.7M**



**Respiratory**  
**\$1.9M**



**Bladder**  
**\$783K**



**Sensory**  
**\$724K**

*The SCIRP AIH investment in the basic, mechanistic research space (FY09-FY19)*

### The SCIRP is a leading funder in AIH research for SCI treatments

AIH involves repeated exposure to air cycling between low and normal oxygen content (hypoxia and normoxia, respectively). These repeated short bursts of hypoxia can enhance neuronal plasticity, which is the ability of neurons to learn and adapt to change. These changes could be an improved response to input or compensation for a lack of input, resulting in an increase in net neuronal function. Enhanced plasticity is a therapeutic goal for many SCI interventions. If neurons can respond better to inputs or learn to respond to new inputs, they may be able to compensate for connections that were lost due to injury. For example, enhancing or repairing the plasticity of motor or respiratory neurons can lead to improved hand, limb, or breathing function, particularly when combined with physical rehabilitation methods. In addition to determining optimal AIH dosages and parameters for restoring function for people living with SCI, some SCIRP-funded projects are looking deeper into understanding the basic mechanisms and circuits involved in how AIH works. Capitalizing on this fundamental understanding of AIH has the potential to expand the utility of this non-invasive therapy to benefit multiple systems and areas in the body.

## The SCIRP also facilitates the utilization of AIH in clinical therapeutic settings

### AIH and high-intensity training to restore upper limb function

This clinical trial tests improvement of hand and arm function by combining AIH with specialized motor training.  
*Dr. William Rymer, Shirley Ryan Ability Laboratory*



*The AIH apparatus and limb training equipment at the Shirley Ryan Ability Laboratory*

### AIH-induced restoration of walking

This clinical trial evaluates the effectiveness of AIH in aiding walking in both ambulatory and non-ambulatory persons living with SCI. *Dr. Randy Trumbower, INSPIRE Laboratory at Spaulding Rehabilitation Hospital and Harvard Medical School*



*The AIH apparatus in use by a participant, monitored by Dr. Trumbower*

# Identifying and validating biomarkers for diagnosis, prognosis, and evaluation of treatment efficacies

A need for better SCI-specific biomarkers was determined to be a critical gap within the research landscape. To address this need, the SCIRP is calling for research proposals aimed at identifying or validating biomarkers with the potential to improve patient outcomes. The following is an example of one such effort.

## Transforming Research and Clinical Knowledge in SCI

TRACK-SCI is an ongoing study collecting patient demographics, treatment, and outcomes data to establish evidence-based standards of care for SCI. TRACK-SCI was developed due to a surprising lack of knowledge about early SCI physiology and evidence-based care practices. This presents a unique challenge for physicians to coordinate effective treatments early after injury. To address this, a multi-institutional team of researchers led by Dr. Michael Beattie developed the infrastructure for an open database of SCI patient information. The effort is funded across multiple SCIRP awards totaling just under \$5M. TRACK-SCI includes an integrative team across institutions (University of California, Fresno; Zuckerberg San Francisco General Hospital; and Ohio State Wexner Medical Center), with the research team led by Dr. Mike Beattie, the clinical team led by Dr. Sanjay Dhall, and the data team led by Dr. Adam Ferguson. As such, this collaboration involves clinicians making critical care decisions, data scientists employing big-data techniques, and researchers translating findings between humans and rodent SCI models.



*Dr. Mike Beattie, Principal Investigator for TRACK-SCI*

## Revolutionizing SCI research with new SCI Lived Experience Consultants (SCILEs) on research teams

Beginning in FY19, the SCIRP mandated that clinical research teams must include people with lived SCI experience as key partners within the study planning and research process. These individuals will provide a much-needed perspective to enhance the short- and long-term impact of this research on patient care. For example, SCILEs are being used in patient-facing capacities, such as participant enrollment, focus groups, project promotion, and sharing research with the broader community. This gives a long overdue seat at the table to those with SCI, providing them a platform with which to guide this groundbreaking research through patient advocacy. The SCIRP looks forward to monitoring and assisting in the integration of SCILEs into our research grants and the broader research community.



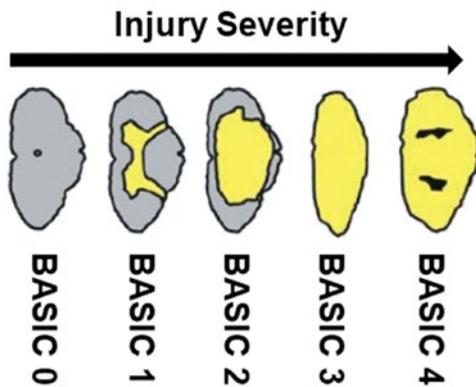
*Chris Barr, TRACK-SCI SCILE*

As part of an FY19 Expansion Award, TRACK-SCI is excited to welcome previous study participant Chris Barr as a SCILE. Chris will provide input on aspects of the growing patient database that are most relevant to people with SCI and assist with project design and dissemination. Speaking recently with SCIRP, Chris expressed:

**“I hope to translate the urgency of an SCI and the need for targeted research, communicating to the TRACK-SCI research team the elements that are likely most important to a person with an SCI.”**

## TRACK-SCI Discoveries

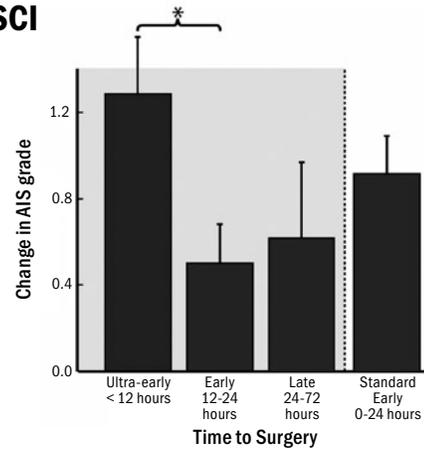
### Imaging as an early prognostic biomarker after SCI



The Brain and Spinal Injury Center (BASIC) score is based on the extent of white matter signal abnormality in SCI patients (ranging from 0, the least severe, to 4, a severe SCI). Adapted from Talbott et al., 2015.

The BASIC score system is an MRI-based method to predict neurological outcomes after SCI. This simple, non-invasive classification system may help distinguish which patients will show functional improvement prior to hospital discharge.

### Surgical timing as a key modulator of recovery after SCI



Early (<12 hours post-injury) surgery and spinal decompression may lead to improved functional recovery compared to surgery that occurs outside of the 12-hour window. Taken from Burke et al., 2019.

A retrospective study showed that early spinal decompression surgery leads to better functional outcomes after SCI. Improvements are based on the American Spinal Injury Association (ASIA) impairment scale or ASIA Impairment Scale (AIS) grade change from admission to discharge.

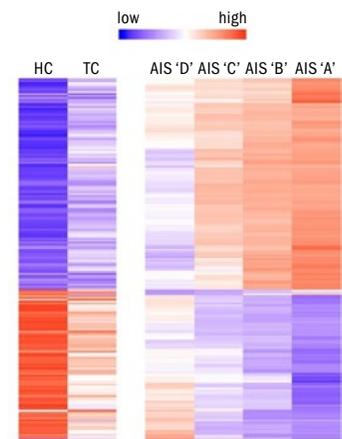
### Critical factors for acute injury management

Stabilization of spinal cord perfusion pressure (SCPP), rather than mean arterial pressure, is now standard of care when managing traumatic SCI at Zuckerberg San Francisco General Hospital. Based on an initial cohort, SCPP monitoring for the first 5 days post-injury looks to be a feasible and safe management technique with no SCPP-related complications reported.

### Using peripheral blood as a biomarker of SCI severity

Blood is easy to collect and quick to analyze in a hospital setting and allows faster evidence-based decision-making. In a pilot study, the team identified 197 gene alternations in the blood of individuals who suffered an SCI compared to control participants. Several of these gene changes were predictive of injury severity, with an overall accuracy of ~72%. This early study establishes the foundational proof of concept for a blood-based injury severity biomarker, though further refinement of the panel is necessary to improve accuracy.

SCI induces transcriptomic changes in white blood cells compared to healthy (HC) and non-central nervous system trauma controls (TC). Each horizontal line represents a different gene, with blue colors representing low expression and red colors indicating high expression of the gene. Most notably, SCI causes disruptions in immune system genes, cellular transport, and cellular activity. These blood profiles for different genes can be used to reliably differentiate between AIS grades. Taken from Kyritsis et al., 2020 (pre-print).



Burke JF et al. 2019. Ultra-Early (<12 Hours) Surgery Correlates with Higher Rate of American Spinal Injury Association Impairment Scale Conversion After Cervical Spinal Cord Injury. *Neurosurgery*. Aug 1;85(2):199-203.

Talbott JF et al. 2015. The Brain and Spinal Injury Center Score: a Novel, Simple, and Reproducible Method for Assessing the Severity of Acute Cervical Spinal Cord Injury with Axial T2-Weighted MRI Findings. *J Neurosurg Spine*. Oct;23(4):495-504.

Kyritsis, N et al. 2020. Blood RNA Profiles are Diagnostic for Severity in Human Acute Spinal Cord Injury. *bioRxiv*. 04.15.037325 (pre-print).

# Preserving and protecting spinal cord tissue at time of injury for improved neurologic outcomes

Novel methods to stabilize an SCI and minimize secondary tissue damage are critical in both the civilian and military settings. Early care strategies that can be delivered at point of injury are of particular relevance to military health, where injuries are occurring in far-forward environments. Here are a few of the neuroprotective approaches supported by the SCIRP.

## A drug intervention for acute injury neuroprotection

A Food and Drug Administration (FDA)-approved drug 4-aminopyridine (4AP) promotes extensive and durable behavioral recovery and decreasing tissue damage when administered early after injury in models of SCI. 4AP can improve brain physiology and outcomes after traumatic brain injury (TBI), and the therapeutic windows for SCI administration of this drug means it can easily be administered in far-forward environments. The team is working toward FDA Investigational New Drug application approval to begin clinical trials in SCI patients.

*Dr. Mark Noble, University of Rochester*



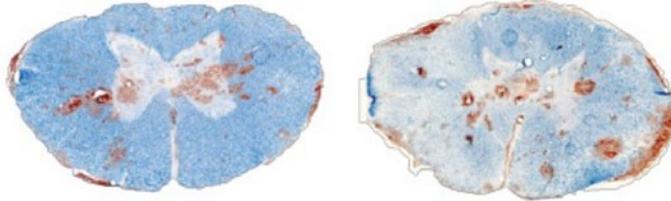
*Testing 4AP administration in multiple models of SCI and TBI to refine treatment windows for far-forward use*

## Acute injury management for mitigation of secondary injury

**Control**



**Blood Pressure Regulation**



*Spinal cord hemorrhage (red) when blood pressure is tightly regulated in various injury phases (compression, decompression, or both) compared to no specific blood pressure control*

Control of blood pressure during acute SCI is critical to reducing spinal cord hemorrhage and improving blood flow and oxygenation to the injured cord. *Dr. Brian Kwon, University of British Columbia*

## New Approaches for Acute Injury Treatment

Treatment of spinal cord-injured mice with an FDA-approved drug that induces mitochondrial biogenesis improves body composition and lesion volume. *Dr. Rick Schnellmann, University of Arizona*

A combination of MRI monitoring with riluzole (an FDA-approved drug currently in Phase II clinical trials) is under investigation as a way to rescue early hemorrhage and edema in spinal cord-injured rats. *Dr. Matthew Budde, Medical College of Wisconsin*

Disruptions of spinal cord oxygenation, blood flow, and cardiac output are reversed by the  $\beta$ -agonist dobutamine in pig models of SCI, revealing advantages over standard vasopressor therapy. *Dr. Christopher West, University of British Columbia*

# Psychosocial issues relevant to people with SCI, their families, and/or their care partners

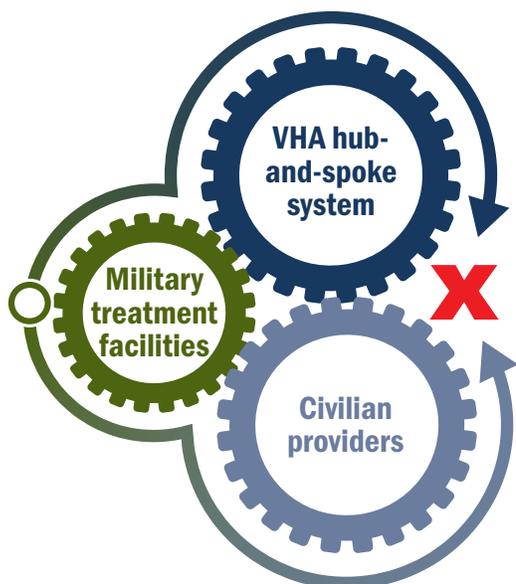
Access to health care, psychological rehabilitation, and reintegration into society are often invisible challenges facing individuals living with SCI. To invest in whole-person solutions, the SCIRP invites research into psychosocial issues including depression, resilience, or self-efficacy. The following are examples of high-impact research within the SCIRP psychosocial portfolio.

## Clinical trial using virtual cognitive behavioral therapy to improve psychosocial recovery in those with SCI

Accessing biopsychosocial care in traditional medical settings is a huge financial, time, and physical burden for individuals with SCI. Transportation and access to SCI-specific care are often insurmountable to individuals in rural settings. These challenges are exacerbated by medical crises such as the COVID-19 pandemic. Remote telehealth interventions offer many unique advantages compared to in-person therapy, including reduced stress, stigma, travel challenges, and scheduling difficulties. To examine telepsychology effectiveness as an intervention for depression in people living with SCI, a clinical trial enrolling 160 participants is currently underway. This study employs a form of cognitive behavioral therapy and will examine the impact of telemedicine delivery on depression, anxiety, and quality of life. The study team hopes that the results of this clinical trial support the widespread acceptance of telepsychology and that its utilization becomes “as usual and routine as in-person psychological treatment” for people living with SCI. *Dr. Kazuko Shem, Santa Clara Valley Medical Center*



*A trained clinical psychologist conducts sessions remotely via device teleconferencing, allowing for better access to mental health care for those with SCI.*



*Integration of care for Veterans with SCI across different health care systems is lacking, especially coordination between the VHA and civilian providers after treatment at military facilities. One major problem is lack of knowledge about treatment options.*

## Qualitative studies examining key gaps in health care integration for veterans with SCI

The pathway to recovery for Service members with an SCI has traditionally not integrated key biopsychosocial services across military treatment facilities, the Veterans Health Administration's (VHA) hub-and-spoke model of health care, and civilian health service providers. Investigation is underway to examine this treatment route and identify unique barriers to care integration. One SCIRP-funded project evaluates key stakeholder positions (patients, caregivers, clinicians) across treatment centers and systems to make recommendations for better integration of whole-person care. *Dr. Suzanne Wood, University of Washington*

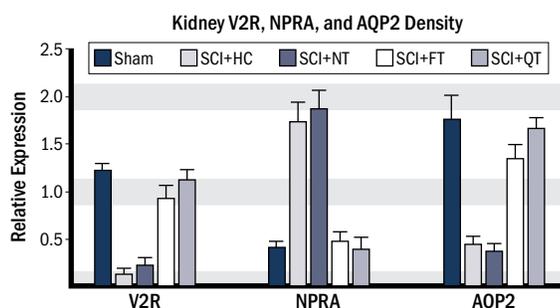
Another SCIRP-funded study, which is a collaboration between the Kessler Foundation (Dr. Denise Fyffe) and VA New Jersey Health Care System (Dr. Carol Gibson-Gill and Joyce Williams), shows that only 30% of Veterans with SCI use their VA benefits, the primary reason being lack of knowledge about these benefits. There also seems to be a lack of coordination for care between VA centers and private clinical SCI treatment centers, and addressing these gaps is critical for the effective care of Veterans with SCI. Recommendations for best practices are being developed to educate and support Veterans with SCI. *Dr. Denise Fyffe, Kessler Foundation*

# Bowel, genitourinary, cardiopulmonary dysfunction, and neuropathic pain

Secondary health effects commonly impose significant impacts on the health and well-being of SCI survivors, often leading to re-hospitalization, chronic health complications, and reduced quality of life. Today, the SCIRP is targeting its investment into specific secondary health effects based on feedback from representatives of the SCI community, as well as the potential for improvements in these areas to enhance daily life for people living with SCI. The following capture examples of the breadth of this area of the SCIRP portfolio.

## Study examining the effects of activity-based training on genitourinary function after SCI

SCI impacts are not restricted to the spine; all major bodily systems are affected by injury. Activity-based training is an avenue that may provide multiple functional benefits: in a rat contusion model, urinary and sexual functions were improved by training. Mechanistic studies reveal that training positively alters key kidney receptor and membrane proteins involved in fluid balance, providing new insight in preventing injury-induced polyuria. *Dr. Charles Hubscher, University of Louisville School of Medicine*



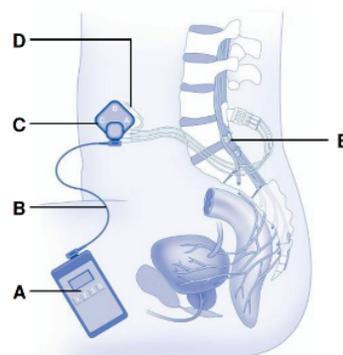
Spinal cord injury alters key proteins controlling fluid balance in the kidney, contributing to disruptions in urinary functions in rats. Forelimb or quadrupedal activity-based training after SCI normalizes levels of these proteins and membrane receptors. Group labels: Sham (surgical control group), SCI+HC (SCI rat sacrificed from home-cage), SCI-NT (SCI without activity-based training), SCI-FT (SCI with forelimb activity-based training), and SCI-QT (SCI with quadrupedal activity-based training). Proteins: V2R (vasopressin receptor 2), NPRA (Natriuretic Peptide Receptor Type A), and AQP2 (Aquaporin 2).

## Gel-formulated drug to treat fecal incontinence in those with SCI

Use of the gel-formulated oxymetazoline applied intra-anally for fecal incontinence reduces the number of bowel movements and extends the time to first bowel movement in healthy subjects. A follow-up clinical trial has shown promising effects for SCI patients in Hungary. *Dr. Nir Barak, RDD Pharma*

## An electrical stimulation device for bladder and bowel symptoms after SCI

Electrical stimulation via an implantable stimulator is being tested to aid in bladder and bowel continence and voiding in SCI patients. Previous use of this technology has required severing sensory nerves to permanently abolish the bladder reflexes. This study, however, is modulating the nervous system and observing functional improvements without purposefully damaging sensory nerves. This Phase I/II clinical trial recently received approval to expand enrollment to include civilians as well as Veterans. The Medicare-funded surgery and device is being tested in civilians with SCI to better match the age range of active-duty Soldiers serving in urban warfare settings. Promisingly, the device allowed urination without catheterization and continence without medication for the first time in 41 years for a recent participant. *Dr. Graham Creasey, VA Palo Alto and Stanford University*



An electrical stimulation device implanted in SCI patients to aid in bladder and bowel function. An external controller (A) is hooked up via a cable (B) to the transmitter (C). The transmitter sends signals to the receiver (D), which stimulates nerves via electrodes (E) to aid in bladder and bowel control.

# Portfolio Snapshot: Pain and SCI



## BASIC RESEARCH INTO SCI PAIN MODELS, MECHANISMS, AND TREATMENTS

Development of Novel, Reproducible Models of SCI Pain and Enhanced Neural Progenitor Transplantation

*Dr. Wendy Campana, University of California at San Diego*

Negative Effect of Morphine Administration on Microglial Balance and Activity After SCI

*Dr. Michelle Hook, Texas A&M University*

Combination of Intensive Exercise and GABAergic Neural Progenitor Cell Transplants Decreases SCI Pain in Rats

*Dr. Jacqueline Sagen, University of Miami*

Anesthesia to Block Pain Signaling Soon After SCI Reduces Tissue Loss and Promotes Recovery

*Dr. James Grau, Texas A&M University*

RNA Aptamers as a Non-Opioid Alternative to Pain Relief After SCI

*Dr. Li Niu, State University of New York Albany*



## DEVELOPMENT OF SCI PAIN MANAGEMENT RESOURCES AND BIOMARKERS

### Spinal Cord Injury Pain Evolution (SCIPE)

A multi-site study to understand the SCI Pain Experience and determine and validate biomarkers that predict development of neuropathic pain.

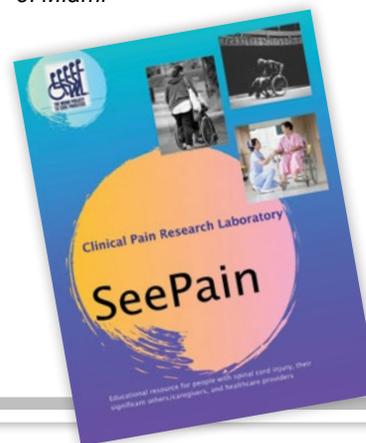
*Dr. Thomas Bryce, Icahn School of Medicine at Mount Sinai*



### SeePain Educational Resource

A resource to help people with an SCI and their care providers discuss pain and pain management more effectively.

*Dr. Eva Widerstrom-Noga, University of Miami*



## CLINICAL IMPACT OF NON-OPIOID TREATMENT FOR SCI PAIN

Clinical Trial Award for non-opioid pain relief, informed by SCI-lived experience researchers and consultants. *Dr. Zina Trost, Virginia Commonwealth University*

# Index of Highlighted Awards

## PAGE 4

W81XWH-16-1-0602, Noninvasive Optical Monitoring of Spinal Cord Hemodynamics and Oxygenation After Acute Spinal Cord Injury, Dr. Brian Kwon, University of British Columbia, FY15 Translational Research Award

W81XWH-16-1-0790, Restoration of Reaching and Grasping Function in Individuals with Spinal Cord Injury Using MyndMove Neuromodulation Therapy, Dr. Kimberly Anderson, MyndTec, Inc., FY15 Clinical Trial Award

## PAGE 5

W81XWH-20-1-0786, Initial Evaluation of an eHealth Self-Management System to Reduce Depression and Increase Resilience After SCI, Dr. David Tulskey, University of Delaware, FY19 Translational Research Award

W81XWH-20-1-0318, Toward Point-of-Care Blood Testing of Biomarkers to Identify Individual Susceptibility for Pressure Injury Development, Dr. Katherine Bogie, Cleveland VA Medical Research and Education Foundation, FY19 Expansion Award

W81XWH-14-2-0129, Restoring Bladder Function by Spinal Cord Neuromodulation in SCI, Dr. Daniel Lu, California, University of Los Angeles, FY13 Clinical Trial Award

## PAGE 6

W81XWH-15-1-0378, Improving Survival and Promoting Respiratory Motor Function After Cervical Spinal Cord Injury, Dr. Warren Alilain, University of Kentucky, FY14 Investigator-Initiated Research Award - Optional Qualified Collaborator

W81XWH-19-1-0413, An Innovative Repair Strategy to Target Inhibitory Glia Scars After Spinal Cord Injury, Dr. Yu-Shang Lee, Cleveland Clinic Foundation, FY18 Translational Research Award

W81XWH-18-1-0530, Improving Spinal Cord Injury Rehabilitation Interventions by Retraining the Brain, Dr. Ela Plow, Cleveland Clinic Foundation, FY17 Clinical Trial Award

## PAGE 7

W81XWH-17-1-0340, Effect of a Novel Intervention Using Daily Intermittent Hypoxia and High-Intensity Training on Upper-Limb Function in Individuals with Spinal Cord Injury, Dr. William Rymer, Shirley Ryan Ability Laboratory, FY16 Clinical Trial Award

W81XWH-15-2-0045, Intermittent Hypoxia-Induced Recovery of Overground Walking in Persons with Subacute SCI, Dr. Randy Trumbower, INSPIRE Laboratory at Spaulding Rehabilitation Hospital and the Harvard Medical School Department of Physical Medicine & Rehabilitation, FY14 Clinical Trial Award

## PAGES 8-9

W81XWH-13-1-0297, Effects of Early Acute Care on Autonomic Outcomes in SCI: Bedside to Bench and Back, Dr. Michael Beattie, University of California at San Francisco, FY12 Translational Research Award

W81XWH-16-1-0497, Early Critical Care Decisions and Outcomes After SCI: TRACK-SCI, Dr. Michael Beattie, University of California at San Francisco, FY15 Translational Research Award - Optional Qualified Collaborator

W81XWH-20-1-0245, Transforming Research and Clinical Knowledge in Spinal Cord Injury (TRACK-SCI), Dr. Michael Beattie, University of California at San Francisco, FY19 Expansion Award

## PAGE 10

W81XWH-17-1-0331, 4-Aminopyridine Promotes Extensive Recovery in Acute Spinal Cord Injury, Dr. Mark Noble, University of Rochester, FY16 Translational Research Award - Optional Qualified Collaborator

W81XWH-14-2-0194, Optimizing Hemodynamic Support of Acute Spinal Cord Injury Based on Injury Mechanism, Dr. Brian Kwon, University of British Columbia, FY13 Translational Research Award

**PAGE 10 - CONTINUED**

W81XWH-19-1-0175, Pharmacological Induction of Mitochondrial Biogenesis for the Treatment of Spinal Cord Injury, Dr. Rick Schnellmann, University of Arizona - Tucson, FY18 Investigator-Initiated Research Award

W81XWH-20-1-0413, Monitoring Early Acute Therapeutic Responses with MRI in Preclinical Spinal Cord Injury, Dr. Matthew Budde, Medical College of Wisconsin, FY19 Investigator-Initiated Research Award

W81XWH-17-1-0660, Offsetting Cardiac Dysfunction in Acute Spinal Cord Injury to Optimize Neurological Outcome, Dr. Christopher West, University of British Columbia, FY16 Translational Research Award - Optional Qualified Collaborator

**PAGE 11**

W81XWH-18-1-0254, Telepsychology Intervention for Individuals with Spinal Cord Injury and Depression, Dr. Kazuko Shem, Santa Clara Valley Medical Center, FY17 Clinical Trial Award

W81XWH-19-1-0354, Evaluating Service Delivery and Support Mechanisms to Improve the Quality of Life for Service Members and Veterans with Spinal Cord Injuries, Dr. Suzanne Wood, University of Washington, FY18 Qualitative Research Award

W81XWH-15-1-0278, Spinal Cord Injury Veterans: Disability Benefits, Outcomes, and Health Care Utilization Patterns, Dr. Denise Fyffe, Kessler Foundation, FY14 Qualitative Research Award

**PAGE 12**

W81XWH-15-1-0656, Improving Urogenital Function with Step Training After Spinal Cord Injury, Dr. Charles Hubscher, University of Louisville Research Foundation, Inc., FY14 Investigator-Initiated Research Award

W81XWH-17-1-0523, Pharmacology of Anal Application of Oxymetazoline in Humans, Dr. Nir Barak, RDD Pharma, FY16 Translational Research Award - Clinical Trial

W81XWH-14-2-0132, Restoration of Bladder and Bowel Function Using Electrical Stimulation and Block After Spinal Cord Injury, Dr. Graham Creasey, Leland Stanford Junior University, FY13 Clinical Trial Award

**PAGE 13**

W81XWH-15-1-0498, Treating Chronic Pain After Spinal Cord Injury, Dr. Wendy Campana, University of California at San Diego, FY14 Investigator-Initiated Research Award

W81XWH-17-1-0629, Derivation of the Mechanisms Mediating the Adverse Effects of Morphine in a Rodent Model of SCI: Functional Recovery and Neuron Loss, Dr. Michelle Hook, Texas A&M University, FY16 Investigator-Initiated Research Award

W81XWH-16-1-0683, Engineered Neural Progenitor Transplants in Combination with Exercise to Maximize Neuropathic Pain Reduction Following SCI, Dr. Jacqueline Sagen, University of Miami Coral Gables, FY15 Investigator-Initiated Research Award

W81XWH-18-1-0807, Nociceptive (Pain) Input After Spinal Cord Injury (SCI) Enhances Secondary Injury: Identifying Treatments That Can Be Translated to Clinical Practice, Dr. James Grau, Texas A&M University, FY17 Investigator-Initiated Research Award

W81XWH-20-1-0385, Testing RNA Aptamers as Analgesic Candidates in a Rat Model of SCI Pain, Dr. Li Niu, SUNY Albany, FY19 Investigator-Initiated Research Award

W81XWH-19-1-0559, Spinal Cord Injury Pain Evolution (SCIPE) Study, Dr. Thomas Bryce, Icahn School of Medicine at Mount Sinai, FY19 Investigator-Initiated Research Award

W81XWH-15-1-0602, Perspectives on Management of Severe Neuropathic Pain After Spinal Cord Injury, Dr. Eva Widerstrom-Noga, University of Miami at Coral Gables, FY14 Qualitative Research Award

W81XWH-20-1-0775, A Multisite Randomized Clinical Trial to Examine the Efficacy and Mechanisms of Immersive Virtual Walking Treatment for Neuropathic Pain in Spinal Cord Injury, Dr. Zina Trost, Virginia Commonwealth University, FY19 Clinical Trial Award

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