DIRECTORY OF GRANT AWARDS
2023 GRANT CYCLE

NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

2023 GRANT CYCLE

DIRECTORY OF GRANT AWARDS FOR SPINAL CORD INJURY AND DISEASE RESEARCH

DECEMBER 2022

NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

This data was compiled in compliance with the New Jersey Commission on Spinal Cord Research's statutory mandate, N.J.S.A. 52:9E-1, "…to compile a directory of spinal cord research being conducted in the State."

The information contained within this directory is not all-inclusive. The research projects and researchers listed in this directory are all based in the State of New Jersey and have applied to and received funding during the fiscal year 2023 grant cycle. The research projects are not categorized or listed in any order.

This directory is not a complete listing of all scientific research being performed within the State of New Jersey due to the proprietary nature of the research being conducted at various institutions throughout the State. In addition, institutions are not obligated to share their research information with the New Jersey Commission on Spinal Cord Research.

Please feel free to contact the New Jersey Commission on Spinal Cord Research at P.O. Box 360, 25 S. Stockton Street, Trenton, New Jersey, 08625. The Commission's office can be reached by telephone at 609-913-5005, or by e-mail at NJCSCR@doh.nj.gov.

For information on the New Jersey Commission on Spinal Cord Research's grant award process, grant applications and deadlines, please see: www.state.nj.us/health/spinalcord.

2023 MEMBERSHIP INFORMATION

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NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

EXPLORATORY RESEARCH GRANT RECIPIENT:

Fan Zhang, Ph.D.
Kessler Foundation
CSCR23ERG001
$199,864

Establishing the Feasibility, Safety, and Efficacy of Spinal Cord Transcutaneous Stimulation with Activity-based Training for Upper Extremity Function Recovery in Individuals with Acute to Subacute Tetraplegia

This study will assess the safety, feasibility, and efficacy of spinal cord transcutaneous stimulation with activity-based training to promote UE functional recovery in acute to subacute cervical SCI.

Approximately 2.96 million people currently live with spinal cord injury (SCI) in the United States (about 6,000 in New Jersey); 59.8% of them suffer from cervical injury resulting in severe impairment or loss of motor and/or sensory function in the arms, hands, trunks, legs, and pelvic organs. For them, recovery of upper extremity (UE) function is the top priority; even partial function restoration would greatly improve the quality of life and thus remains an important goal in SCI rehabilitation. Initiating rehabilitation at an early stage is extremely important and delayed interventions may limit the ultimate functional capability. Current clinical therapies focus on promoting neuroplasticity by performing task-specific activities with high intensity and high repetition. Activity-based training (ABT), paired with stimulation-based strategies, have been evaluated to augment functional recovery in chronic SCI, but improvements were modest. Spinal cord transcutaneous stimulation (scTS) is a novel, non-invasive neuro-modulation technique that can enhance the excitability of spinal networks and enable regaining volitional control required to actively engage with ABT. ABT in turn promote reorganization of the brain and spinal networks, and lead to long-term recovery via neuroplasticity. Implementing scTS+ABT intervention as a daily therapy in inpatient program has the great potential to increase the rate of functional and neurological recovery before the chronicity and emergence of new types of pathology influences long-term recovery.

The goal of this study is to establish the safety, feasibility, and preliminary efficacy of the scTS+ABT intervention in an inpatient rehabilitation program, to facilitate UE functional recovery for individuals with acute to subacute cervical SCI. A total of 30 individuals with acute to subacute cervical SCI will be randomized to receive scTS+ABT, scTSsham +ABT, or ABT alone in a randomized, sham-controlled clinical trial. The intervention will be administered over 2 consecutive weeks, for 30mins/session and 5 sessions/week, as a part of their daily 3-hour therapy. ABT will focus on activities of gross UE movement, grasping, pinching, gross and fine motor skill. Participants in scTS+ABT will receive ABT, while receiving concomitant, active scTS applied at the cervical and thoracic spinal segments over the dorsal skin with optimized and customized stimulation parameters. The sham-control group will go through ABT paired with sham stimulation to control for placebo effects associated with the perception of scTS. In Aim1

and Aim2, we will determine whether scTS+ABT with a 10-day regimen is safe and feasible when applied during an inpatient rehabilitation program. The type, frequency, and severity of adverse event reports (related to scTS, ABT, and SCI) during the intervention course will be reported to evaluate the safety. The feasibility will be assessed based on the ease of recruitment and study completion rate. In Aim3, we will evaluate the efficacy in promoting UE functional recovery in acute to subacute SCI, as compared to the sham control and ABT only. UE motor impairment, maximum voluntary handgrip strength, and functional ability will be quantitatively assessed three time at baseline, once at the end of intervention, and once at 1-, 2-, 3-month follow up. In Aim 4, we will explore the potential neurophysiological mechanism of the combined intervention by evaluating the pre-post changes of cortical and spinal excitability. The success of this study could establish substantial evidence for integrating scTS+ABT into inpatient rehabilitation practice, which will significantly accelerate the functional and neurological recovery in the current clinical care. The findings are expected to provide high quality pilot data for a larger clinical trial to understand the neurophysiological mechanisms and find stimulation parameters for optimal functional outcomes in both acute to subacute and chronic SCI.

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NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

EXPLORATORY RESEARCH GRANT RECIPIENT:

Erica Weber, Ph.D.
Kessler Foundation
CSCR23ERG011
$198,988

Early Intervention for Information Processing Speed Deficits in Acute SCI: A Pilot Study

This study seeks conduct a pilot study to test whether a cognitive training program (BrainHQ) can improve processing speed abilities in individuals with acute traumatic spinal cord injury.

Spinal cord injury (SCI) is a significant public health concern as it affects approximately 18,000 persons in the US per year who incur lifetime costs ranging from $1.8 to $5.4 million each. Decades of research have focused on the physical limitations associated with SCI, as well as therapies for addressing these physical problems. However, it is becoming better acknowledged that many individuals experience significant problems with their cognitive abilities, such as attention, memory, and the time it takes them to process information. Research has shown that people who have cognitive difficulties, compared to those with a purely physical disability, are less likely to be employed, engage in fewer social and work-related activities, have greater difficulties carrying out routine household tasks, and are at higher risk for mental illness. If cognitive issues arise after an SCI, it is more likely that a person would have a more challenging time adapting the many lifestyle changes brought about by their injury, would benefit less from their rehabilitation program, and have more difficulty rejoining the workforce. As it stands, cognitive assessment or rehabilitation is not part of the standard of care for individuals after their SCI because of the relative lack of research in this area.

This study seeks conduct a pilot study to test whether a cognitive training program (BrainHQ) can improve processing speed abilities in individuals shortly after they experience their SCI, by assessing their cognitive and everyday functioning skills after they finish training (and in a subset of participants, 6 months later), with the hopes that this early intervention will improve the long-term trajectory of their overall health and well-being. Cognitive interventions such as BrainHQ impart very few risks, besides mild frustration, and so the risk/benefit ratio of conducting this work is favorable.

This research study was designed as to provide preliminary evidence that can be used to support an application for federal grant funding to conduct a larger, placebo-controlled, randomized clinical trial (RCT). Such a well-designed trial would provide Class I evidence for this intervention, meaning that the project protocol meets the most rigorous standards for clinical trials. Successful completion of this research will therefore have a greater and more rapid impact (approximately 1-2 years after study closure) on the SCI community, as the study results will be able to be published in high impact medical journals with a wide readership of SCI clinicians, and because insurance companies will be more inclined to sanction this intervention for reimbursement.

With better access to high quality cognitive treatment, individuals with SCI will be able to better prevent and address the impact of cognitive problems on their daily lives, and therefore experience greater quality of life and holistic well-being.

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NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

EXPLORATORY RESEARCH GRANT RECIPIENT:

Bonnie Firestein, Ph.D.
Rutgers, The State University of New Jersey
CSCR23ERG002
$200,000

Development of Cypin Inhibitors for the Treatment of SCI-Induced Neuropathic Pain

We will develop inhibitors of the enzymatic activity of cypin, a guanine deaminase, to be used clinically for neuropathic pain following spinal cord injury (SCI).

Spinal cord injury leads to neuropathic pain, often the painful result of nerve damage, which can decrease quality of life. Our group has identified a handful of drugs that inhibit the guanine metabolizing enzyme cypin in the central nervous system that we think plays a role in this type of pain. Administration of inhibitors of cypin decreases pain when touched in female mice with spinal cord injury. However, these inhibitors are not yet useful to treat humans.

We now propose to use medicinal chemistry to produce many new drugs that are similar to our early drugs and that will have properties that are more suitable for development for human use. We will continue using our cellular and spinal cord injury models to test the strength of these drugs.

This study is important, as it could help us identify drugs that could ultimately be used to decrease neuropathic pain after spinal cord injury in humans. Thus, we hope to identify novel drugs to improve quality of life after spinal cord injury.

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NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

INDIVIDUAL RESEARCH GRANT RECIPIENT:

Valerie Tutwiler, Ph.D.
Rutgers, The State University of New Jersey
CSCR23IRG005
$600,000

Mechanisms of Thrombotic Risk Following Spinal Cord Injury

Thrombosis is a major complication of spinal cord injury; we propose to investigate how changes in the dynamic cytokine profile that occur following injury contribute to increased thrombosis risk.

Over 17,000 people in the United States alone are affected by spinal cord injury each year. A major secondary complication of spinal cord injury is venous thromboembolism. Venous thromboembolism occurs when a blood clot forms when or where it is not needed. The blood clot, which is a mixture of cells and a fibrin network, blocks the blood flow to downstream organs. While it is well established that spinal cord injury leads to an increased risk of thrombosis, there is a lack of information pertaining to how spinal cord injury leads to this increased risk.

We propose to investigate how changes in inflammation that occur following spinal cord injury contributes to blood clotting. To achieve this goal, we combine animal models with cutting edge experimental techniques that will allow us to probe the influence of changes that occur due to spinal cord injury on the components of the blood clot. These studies will improve diagnoses and treatment of thrombosis in patients with spinal cord injury.

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NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

FELLOWSHIP RESEARCH GRANT RECIPIENT:

Einat Haber, M.D.
Kessler Foundation
CSCR23FEL002
$100,000

Neuromodulation of Blood Pressure using Transcutaneous Spinal Stimulation in Individuals with a Sub-Acute Spinal Cord Injury

Examine the use of transcutaneous spinal stimulation in treating orthostatic hypotension in individuals with a sub-acute spinal cord injury (up to 45 days after injury).

In the United States, there are approximately 296,000 people with spinal cord (SCI), and about 17,900 new cases each year. In New Jersey alone, there are approximately 6,000 residents with SCI and >200 new injuries each year. Traumatic SCI is often a devastating life-changing condition that results in a high degree of long-term disability and morbidity. It is common that individuals with high level SCI (thoracic level T6 and above) develop cardiovascular dysfunction characterized by low unstable resting blood pressure (BP) and orthostatic hypotension (OH). OH is defined as a decrease of 20/10 mmHg in systolic/diastolic BP when moving from supine to an upright position. Symptoms include lightheadedness, dizziness, weakness, fatigue, cognitive impairment, nausea, and fainting. OH typically presents in the early phases after an SCI and was reported to affect 74% of physical therapy treatments in individuals with acute SCI, interfering with participation in rehabilitation programs. Length of stay at rehabilitation facilities in the US has substantially shortened in the past decades, providing a compelling rationale for early identification and treatment of OH.

The first line of intervention includes appropriate salt and fluid intake and compression stockings, among other nonpharmacologic interventions. When not sufficient, those are combined with pharmacologic interventions such as Midodrine; however, most interventions lack supporting evidence. While other treatments such as functional electrical stimulation (FES) of the lower limbs have been suggested, none are routinely in use today and alternative treatments for OH during the early time-period after SCI are sought.

In recent years, spinal stimulation has shown great promise in restoring voluntary leg movement in individuals with a chronic SCI and opened the door for various applications including cardiovascular control. Several studies demonstrated that epidural stimulation (ESS) restores BP and resolves orthostatic symptoms in individuals with a chronic SCI. However, ESS necessitates spinal surgery, therefore limiting the number of participants in trials. Spinal cord transcutaneous stimulation (scTS) represents an alternate approach, with greater potential to benefit large numbers of individuals and fewer risks. The only study so far to use scTS to restore cardiovascular function demonstrated an increase in BP and orthostatic tolerance in five individuals with a high chronic SCI.

The present study is an innovative crossover randomized controlled trial (RCT) of individuals with a new high-level SCI who suffer from OH during their early comprehensive rehabilitation hospitalization (7-45 days after injury). The primary aim of this study is to test the efficacy of optimal scTS, compared with sham stimulation, to increase and normalize BP and mitigate OH symptoms, during a sit-up orthostatic stress test.

The present proposal is highly relevant to the mission of the NJCSCR and its research program in several ways. It is the first study to apply spinal cord stimulation (epidural or transcutaneous) to address OH during the sub-acute settings following SCI. OH is more frequent and severe in the earlier phases after SCI, and often interferes with full participation in therapy sessions during inpatient rehabilitation, where every day of therapy is important, and which has dramatically shortened in recent decades. This innovative restorative rehabilitation technique has the potential to improve both the physical well-being and the functioning of individuals with a SCI, not only during inpatient rehabilitation, but also in the long run, as a subset of this population continues to suffer from OH for many years. Additionally, this study is an important step in integrating scTS into the early recovery phase, not only to improve autonomic cardiovascular function, but also for other potential benefits during inpatient rehabilitation.

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NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

FELLOWSHIP RESEARCH GRANT RECIPIENT:

Chee Meng Eugene Cheong
Rutgers, The State University of New Jersey
CSCR23FEL008
$60,000

SCI Scar Digestion Using Enzyme Nanoparticles Designed By AI-Driven Robotics

The goal of this project is to undertake drug development for enzyme nanoparticles designed by AI-driven robotics.

Current spinal cord injury (SCI) treatments include surgery to stabilize the injury site, followed by corticosteroid treatments to limit inflammatory response and provide rehabilitative care. To date, steroid treatment using methylprednisolone has shown to be somewhat effective in reducing the extent of permanent paralysis and marginally improve outcomes. Unfortunately, none of these current treatments can reverse the damage to the spinal cord, particularly for patients with chronic injuries. Treatments using the enzyme chABC have shown the enzyme's ability to degrade scar tissue and enhance spinal cord plasticity and neuronal regeneration in various animal models. Our novel nanoparticle formulation uses complex polymers to stabilize and deliver this unstable enzyme to improve neuronal tissue regeneration. The advantage of our approach is that it seeks to specially formulate a well-documented enzyme therapy for SCI scar tissue reduction. This greatly increases the translatability of our therapy as the bioactive component is proven.

This focus on improving the neurologic recovery of SCI patients with previous SCIs is perfectly aligned with the goals of the NJCSCR program and the State of New Jersey. The main barrier for improving quality of life is the obstructing scar tissue at the site of injury. We propose a new drug construct that can be injected into the site of injury to digest this scar tissue and improve neural plasticity. If successful, this pharmacologic intervention could greatly impact New Jersey patients with new injuries as well as the currently disabled population.

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