

NJCSCR 2017



NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

Annual Report State Fiscal Year 2017



NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

2017 ANNUAL REPORT

January 30, 2018

The Honorable Phil Murphy
Governor of New Jersey
Office of the Governor
State House – P.O. Box 001
Trenton, New Jersey 08625

Dear Governor Murphy:

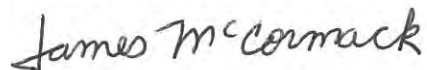
On behalf of the New Jersey Commission on Spinal Cord Research, and the citizens with spinal cord injury, it is our privilege to present the 2017 Annual Report.

Once again, the Commission has had an active and productive year. We have recently completed the 22nd annual competition for spinal cord injury research projects.

In 2017, the Commission awarded over \$2 million in spinal cord injury research grant funding. Each of the funded research projects has the potential to contribute significantly to the development of treatments and cures for the paralysis and secondary complications that accompany spinal cord injury. These grants facilitate the basic research findings necessary to compete successfully for larger National Institutes of Health, and National Science Foundation awards. In addition, they help attract talented scientists and students to this exciting and promising field in New Jersey.

We wish to thank you, and the State of New Jersey for continued support of spinal cord injury research.

Sincerely,



James McCormack
Chairman

NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH



2017 ANNUAL REPORT

**New Jersey Commission on Spinal Cord Research
Members of the Commission at the time of publication (2018)**

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ACKNOWLEDGEMENTS

The New Jersey Commission on Spinal Cord Research would like to express its sincere appreciation to all present and past Commission members, and the New Jersey Department of Health staff.

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The New Jersey Commission on Spinal Cord Research was established in 1999 to fund spinal cord injury research projects in New Jersey.



Since 2001, the New Jersey Commission on Spinal Cord Research (Commission) has awarded over \$50 million to individual scientists at academic and research institutions and approved 213 separate scientific research projects.

- Since 2001, 183 scientific research projects have been completed.
- Progress made by researchers has been presented in abstracts, scientific conferences, symposia, and meetings.
- Commission programs have facilitated wider scientific interaction and numerous active research collaborations, along with out-of-state researchers.
- Success in achieving Commission funding has

resulted in academic and career advancement for New Jersey researchers, including doctoral dissertations.

- Numerous successful applications to the National Institutes of Health, the National Science Foundation and other organizations based on the Commission's grants have been made.

❖ Four grant programs were offered in Fiscal Year 2017:

- Individual Research Grants
- Exploratory Research Grants
- Postdoctoral and Graduate Fellowship Grants
- Spinal Cord Injury Techniques Training Travel Grants

❖ 2017 Achievements:

- Thirty-one applications requesting a total of \$9.4 million were submitted.
- Nine awards were made in 2017 totaling \$2,012,000.
- Two Individual Research Grants totaling \$1,200,000, four Exploratory Research Grants totaling \$800,000, and three Spinal Cord Injury Techniques Training Travel Grants totaling \$12,000 were approved.

INTRODUCTION

This report is written in accordance with the enabling Statute, which stipulates that the Commission shall provide a report to the Governor and Legislature on the status of the Commission's activities and the results of its funded research efforts.¹

The Spinal Cord Research Act created the New Jersey Commission on Spinal Cord Research and the New Jersey Spinal Cord Research Fund to support its activities. This Act resulted from the collaborative efforts of people with spinal cord injury and their families, clinicians, scientists, public officials, and representatives of research, rehabilitation and non-profit organizations.

BACKGROUND

Spinal cord injuries can be some of the most devastating and life-changing injuries a person can sustain. Depending on the severity and location of the injury, a spinal cord injury can cause paralysis and death. Spinal cord injury has long been regarded as a virtually hopeless diagnosis with a grim prognosis. However, innovative approaches to rehabilitation and modern medicine have extended life expectancy from months to years and even decades. Many people with permanent injury can now live vital and productive lives. More recently, breakthroughs in research and new horizons in the life sciences are moving us closer to finding cures for spinal cord injuries.

Spinal cord injury impacts individuals and families across the State and nation. Though young men remain at greatest risk, the number of women and older people suffering a spinal cord injury is increasing. Motor vehicle crashes remain the leading cause of spinal cord injury, followed by falls and acts of violence such as gunshot wounds.²

The economic and human cost of these injuries remains huge. Better therapies are needed, and the task of research is more demanding than ever. Paralysis resulting from spinal cord injury may no longer be "an ailment not to be treated," but the search for the answers remains among the greatest challenges to medical science and the healing arts.

1. N.J.S.A. C.52:9E-1 et seq. Enabling statute is attached hereto as "Attachment A."

2. National Spinal Cord Injury Facts and Figures at a Glance. <https://www.nscisc.uab.edu/Public/Facts%202016.pdf>.

NEW JERSEY SPINAL CORD REGISTRY

The Spinal Cord Research Act mandated the establishment of a central registry of persons who sustain spinal cord injuries other than through disease, whether or not the injury results in a permanent disability. The Registry captures incidence and prevalence data on spinal cord injuries and serves as a resource for research, evaluation and information on spinal cord injuries. See data and tables attached hereto as “Attachment B”.

NEW JERSEY’S COMMITMENT TO SPINAL CORD RESEARCH

New Jersey is a leader in funding research aimed at the repair of spinal cord injuries. The Commission, created in 1999 under New Jersey’s Spinal Cord Research Act, represents the successful culmination of years and determined effort to enlist New Jersey in the fight. The Commission offers research grant programs for both established scientists and younger researchers committed to spinal cord injury research.

Now in its 18th year of operation, the Commission has funded 213 scientific research projects and supported individual scientists at research institutions in New Jersey. Its impartial and scientifically rigorous application and review process has helped make the Commission vital to New Jersey’s scientific investigators in their pursuit of developing effective therapies for spinal cord injury.

The Commission remains committed to broadening its portfolio of institutional grantees and increasing the size and diversity of its funding activities. Through outreach activities, the Commission encourages participation by all research organizations with an interest in spinal cord research.

NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

1. MISSION AND GOALS

The Commission’s mission is to encourage and promote scientific research projects that advance the understanding of spinal cord injury and explore potential therapeutic strategies at qualifying research institutions in New Jersey. Through its grant programs and related activities, the Commission reinforces New Jersey’s preeminence as a center of biomedical research, and a leader in neuroscience, neurotrauma and spinal cord research.

Simply stated, the Commission's goals are:

- To support meritorious research projects that advance the understanding of spinal cord injury and explore potential therapeutic strategies.
- To support the progression of research from bench to bedside.
- To enhance the reputation of New Jersey as a focus of biomedical research, and
- To facilitate the initiatives of New Jersey scientists to obtain larger grants from sources such as the National Institutes of Health and the National Science Foundation.



2. OBJECTIVES

The Commission is committed to accelerating research to develop effective interventions and cures for disabilities such as paralysis that are associated with spinal cord injury. Its primary objectives are:

- To develop and implement spinal cord research grant programs.
- To solicit, review, and administer grant awards in support of scientifically meritorious research projects.
- To promote development of spinal cord research projects that focus on treatments, cures, and on those that prevent or treat secondary biological conditions resulting from spinal cord injury, and
- To support the progression of research from laboratory to animal and clinical applications.

More specifically, the Commission works to:

- Advance the field of spinal cord research in New Jersey by encouraging established scientists to apply their expertise to spinal cord research.
- Foster collaborative, interdisciplinary approaches to spinal cord research.
- Nurture future generations of spinal cord researchers by supporting young scientists and postdoctoral fellows.
- Prevent or treat secondary biological conditions resulting from spinal cord injury, and
- Disseminate the research findings generated by scientists supported by the Commission.

MEMBERSHIP AND ORGANIZATION

NJ COMMISSION ON SPINAL CORD RESEARCH 2017

3. MEMBERSHIP AND ORGANIZATION

Created as a semi-independent public body, the Commission is “...allocated in, but not of...” the New Jersey Department of Health. The Commission is subject to all the administrative rules and procedures of the Department, but it is not a part of the Department’s budget.

The Commission establishes and oversees the administrative operations of the grant-making process as well as other program activities that are implemented by its administrative staff. Eleven uncompensated Commissioners are appointed by the Governor with the advice and consent of the Senate and serve three-year term.

The Commission will always have one or more individuals from each of the following institutions and categories

The Commissioner of the New Jersey Department of Health, or designee, Rutgers, The State University of New Jersey; one representative of the federally designated Spinal Cord Injury Model System (Kessler Foundation); one representative from the American Paralysis Association (Christopher & Dana Reeve Foundation); and six public members – at least one licensed physician and one person with a spinal cord injury.

All public members shall be residents of the State, or otherwise associated with the State and should provide a diversity of backgrounds and interests united by a shared commitment to the cause of spinal cord research.³

Any qualified person wishing to be considered for appointment may submit his or her name to the Governor’s Office of Appointments.⁴

Public meetings are held at least four times a year. Members are recused from discussing or voting on matters in which they may have a potential conflict. A Chair and Vice Chairperson are elected and preside over all formal proceedings.

The Commission also maintains committees that meet and provide an informal structure to discuss issues on an ad hoc basis in advance of presenting them to the full Commission.

3. New Jersey Statute (N.J.S.A.52:9E-1 et seq.)

4. Information on how to apply can be found on the following website at: <http://www.state.nj.us/governor/admin/bca>

RESEARCH FUNDING PRIORITIES

NJ COMMISSION ON SPINAL CORD RESEARCH 2017

4. ADMINISTRATION

The Commission's administrative office provides the vital linkages and services to implement its programs and ensure the integrity of its operations. The administrative staff manages the day-to-day operations, including grant program administration, interaction with applicants and grantees, contract administration, budgeting and financial matters, record-keeping and reporting.

Administrative staff schedule and facilitate all activities, manage the scientific merit review process, negotiate with outside vendors, and maintain the necessary relationships within state government.

5. FUNDING

Under the enabling Statute, the work of the Commission is supported entirely by a one-dollar surcharge on all New Jersey traffic and motor vehicle fines or penalties. Monies generated from these fines or penalties are collected by the State Treasurer for deposit into the New Jersey Spinal Cord Research Fund. All grant programs and other activities are funded entirely from this dedicated source. No part of the operating budget is paid for out of New Jersey's general tax revenue.

RESEARCH FUNDING PRIORITIES

The Research Program Guidelines set forth the Commission's scientific agenda, research criteria and areas of interest.⁵ The guidelines offer applicants detailed guidance and instruction on funding criteria and policies.

The Commission funds research activities that hold promise of developing effective interventions and cures for paralysis and other consequences of spinal cord injury and disease. An array of grant programs is offered including Individual Research Grants, Fellowship Grants, Exploratory Research Grants, and Spinal Cord Techniques Training Travel Grants. The areas of research listed below highlight the focus of current emphasis and funding to:

5. The full text appears on the website at: www.nj.gov/health/njcsr

GRANT APPLICATION AND REVIEW PROCESS

NJ COMMISSION ON SPINAL CORD RESEARCH 2017

- Study strategies to promote neuronal growth and survival, encourage the formation of synapses, enhance appropriate myelination, restore axonal conduction, replace injured cells, or otherwise improve function after spinal cord injury.
- Evaluate efficacy of drugs and other interventions that prevent or reduce secondary neuronal injury or providing insight into the mechanisms causing progressive damage.
- Define anatomical characteristics of spinal cord injury or disease in well-defined animal models and in the human spinal cord, specifically documenting the cellular systems vulnerable to injury or disease and the functional losses which occur as a result thereof.
- Elucidate biological or physical mechanisms underlying approaches to improve functions compromised by spinal cord injury, e.g., bladder, bowel, and sexual function, and alleviate chronic pain, spasticity, and severe hypertension.
- Develop strategies to prevent or treat secondary complications arising from injury or disease to the spinal cord.
- Develop innovative restorative rehabilitation strategies to promote recovery of biological function.
- Translate basic and pre-clinical findings into clinical application.
- Support the investigation of promising new approaches.

GRANT APPLICATION AND REVIEW PROCESS

The grants review process was modeled on the National Institutes of Health standards and procedures to provide an impartial and rigorous review of research proposals.⁶ This effort has been largely successful and has earned respect from grantees and applicants.

Application Process

The grant application process is now entirely electronic utilizing the State of New Jersey System for Administering Grants Electronically (SAGE).⁷ The online process ensures broad access, convenience, flexibility and greatly reduces administrative workloads for applicants, the Commission office, and the Scientific Merit Review Panel.

Grant Review Process

The grant review process consists of a three-step review.

- First, all grant applications are reviewed by the Commission's administrative staff to ensure compliance with New Jersey Statutes and regulations and to ensure accuracy.

6. <https://www.nih.gov/sites/default/files/about-nih/nih-director/testimonies/nih-policies-procedures-promoting-scienc>

7. <https://njsage.intelligrants.com/Login2.aspx?APPTHEME=NJSAGE>

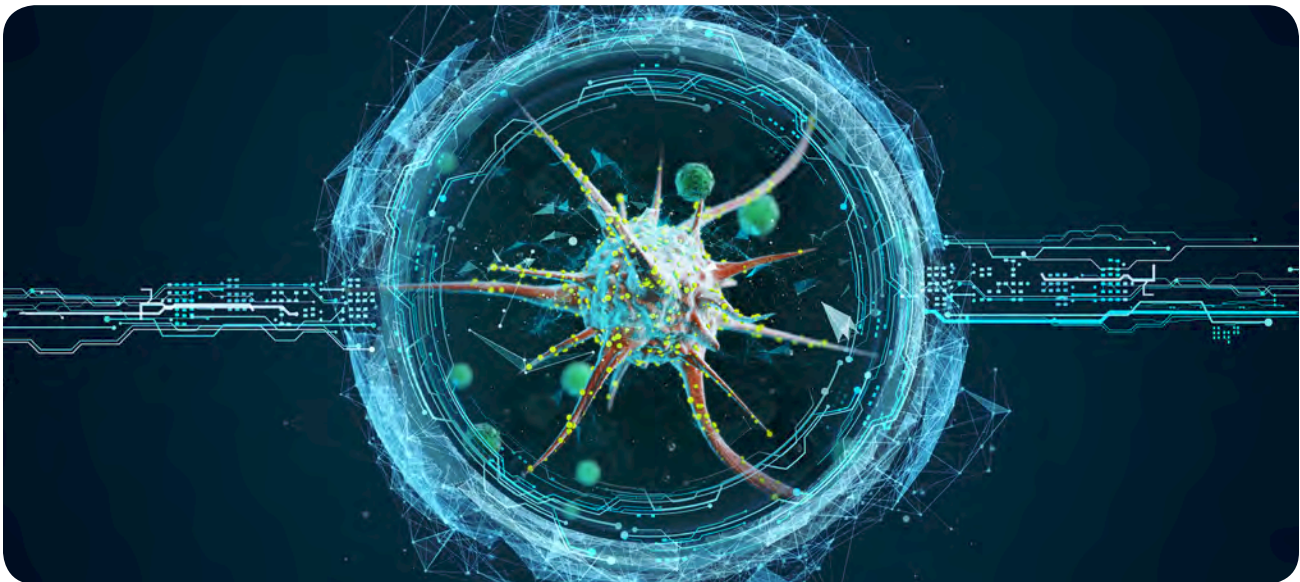
GRANT APPLICATION AND REVIEW PROCESS

NJ COMMISSION ON SPINAL CORD RESEARCH 2017

- Second, an independent relevance review is conducted by a three-person panel appointed by the office of the Commission. The panel determines the relevance of all applications to the Commission's mission, priorities and Research Program Guidelines, and will assign scientific reviewers for each proposal that meets the relevancy requirements. In the event the panel determines that an application does not meet those requirements, the application will be triaged, and will not be forwarded for independent scientific merit review.
- Third, members of the Independent Scientific Merit Review Panel convene to evaluate all grant applications forwarded by the Independent Relevance Review Panel, applying the criteria described below. This panel will assign scores to each application and make funding recommendations to the Commission. If it is determined that an ad hoc expertise is needed, additional scientific referees may be used.

Recommendations and Authorization

The Independent Scientific Merit Review Panel will forward its recommendations to the Commission for final review and action. Grants triaged by either the Independent Relevance Review Panel and/or the Independent Scientific Merit Review Panel will not be forwarded to the Commission and will not be funded.⁸



8. The authority to authorize or not authorize grants is fully vested in the Commission according to New Jersey Statute (N.J.S.A. C.52:9E-1).

CURRENT GRANT PROGRAMS

Grant programs are designed to provide scientific opportunities for researchers. Awards are intended to promote collaboration among spinal cord researchers in New Jersey and encourage innovative research. The intent is not to provide long term support for research. It is expected that this initial support will lead investigators to acquire the necessary levels of preliminary data, so they may compete successfully for federal grant support.

The Individual Research Grant is designed to fund senior independent researchers, while the Fellowship Research Grant offers encouragement to graduate students and postdoctoral researchers. The Exploratory Research Grant enables researchers to apply innovative ideas from other areas of science to spinal cord injury and repair, and the Spinal Cord Injury Techniques Training Travel Grant offers applicants the ability to participate in training courses on spinal cord injury techniques.

Inter – institutional and/or inter-state collaboration is strongly encouraged. Complete details on all grant programs are available on the Commission’s website.⁹

INDIVIDUAL RESEARCH GRANTS

- Individual Research Grants support senior scientists to explore meritorious novel scientific and clinical ideas.
- Up to \$600,000 for up to three years (\$200,000 per year).
- A key goal is to enable established researchers to test and develop pilot data needed for future funding.

FELLOWSHIP RESEARCH GRANTS

- Postdoctoral and Graduate Student Fellowships engage promising young investigators in spinal cord research.
- All fellowships include an annual stipend, research allowance and travel budget.
- Postdoctoral Fellowships run for three years with a total award of \$150,000; (\$50,000 per annum).
- Graduate Fellowships run for two years with a total award of \$60,000; (\$30,000 per annum).

⁹. <https://nj.gov/health/spinalcord/>

SUMMARY AND PERFORMANCE RECORD

NJ COMMISSION ON SPINAL CORD RESEARCH 2017

EXPLORATORY RESEARCH GRANTS

- Enable independent investigators to apply their specific expertise to spinal cord research.
- Develop preliminary data needed to justify higher levels of funding.
- Apply innovative ideas from other areas to spinal cord research.
- Encourage inter-institutional and/or inter-state collaborations.
- Allow up to \$200,000 for a two-year non-renewable grant.

SPINAL CORD INJURY TECHNIQUES TRAINING TRAVEL GRANTS

- Offer applicants the ability to participate in training courses on spinal cord injury techniques.
- Applicants may select a course on their own or attend a course at either Rutgers, The State University of New Jersey, or the Spinal Cord Injury Research Training Program located at Ohio State University.
- A one-time per applicant non-renewable award of up to \$4,000 is provided.

2001-2017 SUMMARY AND PERFORMANCE RECORD

Since 2001, the Commission has invested \$50,311,255.90 in New Jersey scientists. Scientific interest in the field of spinal cord injury research remains strong due to the ongoing investment of these funds.

Approximately 30 grant applications are received annually; approval of ten or more new grant awards totaling \$2 to \$3 million are made.

Due to its continued investment in spinal cord injury research, the number of New Jersey researchers interested in the field is growing.

GRANT APPLICATIONS

To date, the Commission has received 673 applications by scientists at New Jersey academic and research institutions. These awards represent an investment in spinal cord injury research, which cumulatively total \$188.7 million in grant funding requests.

The Commission has explored a range of grant programs that provide opportunities for both senior and young researchers, and larger programs for establishing new spinal cord research facilities and support for professorships.

QUALIFIED RESEARCH INSTITUTIONS

NJ COMMISSION ON SPINAL CORD RESEARCH 2017

Applications for Individual Research grants typically account for about two-thirds of the total. These projects are aimed at advancing the field in significant ways and result in scientific publications as well as additional funding.

GRANT FUNDING AWARDS

Individual Research Grants awarded to established investigators are the mainstay of spinal cord research in New Jersey. These projects aim at advancing the field in significant ways and are most productive as measured by publications and applications for additional funding.

The Fellowship Research Grant program is the Commission's most cost-effective initiative, as measured by the number of researchers supported per grant dollar. The Commission is committed to bringing new researchers and promising students into the field. Its programs of graduate and postdoctoral Fellowships have been a success, in both numbers and qualified applicants.

NEW JERSEY QUALIFIED RESEARCH INSTITUTIONS

The Fellowship Research Grant program is the Commission's most cost-effective initiative, as measured by the number of researchers supported per grant dollar. The Commission is committed to bringing new researchers and promising students into the field. Its programs of graduate and postdoctoral Fellowships have been a success, in both numbers and qualified applicants.

- o Rutgers, The State University of New Jersey
- o Kessler Foundation
- o Princeton University
- o Coriell Institute for Medical Research
- o New Jersey Institute of Technology
- o VA New Jersey Health Care System & Veterans Biomedical Research Institute
- o Stevens Institute of Technology
- o Drew University
- o Hackensack Meridan Health, JFK Medical Center - The Neuroscience Institute
- o Progenitor Cell Therapy, LLC
- o Hackensack Meridan School of Medicine at Seton Hall University, Seton Hall University
- o Wyeth Research/Pfizer
- o TRIM-edicine, Inc.
- o Rowan University
- o Cooper University Hospital, Cooper Medical School of Rowan University, Cooper Health System
- o Hackensack University Medical Center
- o Celvive, Inc.
- o Montclair State University

The Commission is committed to broadening its portfolio of institutional grantees and increasing the size and diversity of its funding activities. Through outreach activities, the Commission encourages participation by all research organizations with an interest in spinal cord research.

COMMISSION ACHIEVEMENTS

Although a cure for spinal cord injury remains elusive, the investment of millions of dollars by the Commission and other organizations has led to a wealth of new knowledge and insights that hold promise for effective therapies and cures. Below is a summary of the Commission's achievements:

- Grantees and their institutions have capitalized on the opportunities afforded by the availability of Commission funding. Scientific knowledge and careers have been advanced as well as institutional revenue and scientific achievements.
- The Commission has been a major factor in fostering the interest and continued involvement in spinal cord research within the State of New Jersey.
- Numerous scientific articles reporting on the work funded by Commission have appeared in peer-reviewed scientific publications, and several articles are about to be published. Progress made by researchers has been presented in numerous abstracts, scientific conferences, symposia, and meetings.
- The grant programs have facilitated greater scientific interaction and research collaborations, both in New Jersey and nationally.
- Success in achieving funding has resulted in academic and career advancement for New Jersey researchers, including doctoral dissertations. Applications to the National Institutes of Health, the National Science Foundation, and other organizations have been submitted, due to the work funded by the Commission.

2017 YEAR IN REVIEW

In 2017 the Commission witnessed its 18th year of operation and 22nd grant cycle. Thirty-one applications were submitted with requests for funds totaling \$9.4 million.

2017 Overview and Applications

Nine applicants were awarded a total of \$2,012,000 in 2017. Two Individual Research Grants totaling \$1,200,000, four Exploratory Research Grants totaling \$800,000, and three Spinal Cord Techniques Training Travel Grants totaling \$12,000 were funded.

2017 Outreach and Development Efforts

The Commission maintains an ongoing interest in expanding spinal cord injury research in New Jersey. Direct contacts, attendance at events and meetings, plus its website and publications are some of the resources used to publicize grant opportunities throughout the State.

Publication of Grant Programs

Official Notices of Fund Availability advise interested parties of the Commission's grant programs. These notices are published annually on the Commission's website and in the New Jersey Department of Health's Directory of Grant Programs.¹⁰ In Fiscal Year 2017, one grant cycle was offered; resulting in the availability of up to \$6.5 million for spinal cord research projects.

2017 Grant Cycle Information

Grant Application Deadline: December 12, 2016

Award Notification Date: June 30, 2017

Available Grant Programs:

- Individual Research Grants
- Exploratory Research Grants
- Fellowship Grants
- Spinal Cord Injury Techniques Training Travel Grants

10. NJ Department of Health Directory of Grant Programs: www.healthapps.state.nj.us/noticeofgrant/noticegrants.aspx

GRANT PROGRAMS FOR 2018

For Fiscal Year 2018, an estimated \$3.1 million has been allocated for spinal cord injury research projects. The Commission authorized one grant cycle for Fiscal Year 2018 offering Individual Research Grants, Fellowship Research Grants, Exploratory Research Grants and Spinal Cord Injury Techniques Training Travel Grants.

2018 Grant Cycle Information

Grant Application Deadline: **December 11, 2017**

Award Notification Date: **June 30, 2018**

AVAILABLE GRANT PROGRAMS:

- Individual Research Grants
- Exploratory Research Grants
- Fellowship Grants
- Spinal Cord Injury Techniques Training Travel Grants

FINANCIAL STATEMENT

The activities and programs of the Commission are supported by the New Jersey Spinal Cord Research Fund as established by the Act. A one-dollar surcharge is imposed on all fines or penalties from motor vehicle or traffic violations. This revenue surcharge is collected and forwarded to the New Jersey State Treasurer. The funds are then deposited monthly in an interest bearing account designated as the New Jersey Spinal Cord Research Fund.

STATE FISCAL YEAR 2017 FUND BALANCE STATEMENT:

	SFY 2017 <i>Projected</i>	SFY 2017 <i>Actual</i>	SFY 2018 <i>Projected</i>
Opening Fund Balance (July 1)	\$366,097	\$735,407	\$794,449
Revenues			
Assessments ¹	\$3,600,000	\$3,716,546	\$3,600,000
Investments Earnings - Interest ²	\$15,000	\$49,829	\$15,000
Total Revenue:	\$3,615,000	\$3,766,375	\$3,615,000
Total Funds Available	\$3,981,097	\$4,501,782	\$4,409,449
Disbursements and Expenses			
Spending Plan Reduction			
Disbursements to Grantees ³	\$3,600,000	\$3,394,362	\$3,600,000
Total disbursements	\$3,600,000	\$ 3,394,362	\$3,600,000
Expenses			
Administrative & Office expense	\$275,000	\$288,870	\$290,000
Professional Review Panel	\$35,000	\$24,101	\$35,000
NJCSCR Registry	\$0	\$0	\$0
Total expenses	\$310,000	\$312,971	\$325,000
Total Disbursements and Expenses	\$3,910,000	\$3,707,333	\$3,925,000
Closing Fund Balance (June 30)	\$71,097	\$794,449	\$484,449

¹ Net Revenue Variance
² Funds Plus Interest Deposited Annually in January
³ Funds for Multi-Year Grants

Below is a project summary of the Individual Research Grant recipients:

CSCR17IRG010 - \$600,000

KiBum Lee, Ph.D.

Rutgers, The State University

610 Taylor Road

Piscataway, NJ 08854-8066

848-445-2081

kblee@rutgers.edu

Project Title: A Biodegradable Nanoscaffold for the Co-Delivery of Patient Derived Neural Stem Cells and BET Inhibitor for Anti-Inflammation and Synaptic Restoration Post-SCI.

A novel biodegradable nanoscaffold loaded with BET inhibitors for improving stem cell and anti-inflammatory therapy simultaneously to effectively promote functional recovery after spinal cord injury. Spinal cord injury (SCI) is one of the most common causes of disability in young adults, affecting approximately 12,000 people in the United States every year. Spinal cord injury (SCI) results in many cellular dysfunctions that may cause severe and permanent neurological deficits. Several current therapeutic approaches are aimed at bridging the lesion site through cellular transplantation to restore neural signaling, reduce inflammation, and prevent subsequent damage to the injured area. Given the intrinsically limited regenerative potential of the central nervous system (CNS) and the complex inhibitory environment of the injured spinal cord, effective strategies to generate a robust population of functional neurons derived from autologous neural stem cells (NSCs) re-establishing the damaged neural circuitry are urgent clinical needs. However, several pertinent obstacles hinder successful transplantation strategies. First, due to the inflammatory nature of the injured spinal cord, most NSCs die soon after transplantation. Second, the extracellular matrix of the injured spinal cord is not very conducive to NSC survival and differentiation. Thus, we will address these challenges by combining a novel bioscaffold with a small compound that reduces inflammation and promotes neuronal differentiation.

To address the aforementioned challenges in SCI, the overall objectives of this proposal are:

- i) to develop a multifunctional nanomaterial-based bioscaffold methodology for the controlled delivery of therapeutic molecules;
- ii) to incorporate nanomaterial-based bioscaffold into the enhanced transplantation of human-induced pluripotent stem cell (iPSC)-derived neurons; and
- iii) to evaluate the

combined therapeutic effect of spatiotemporal delivery of therapeutic molecules and stem cell therapy for the effective treatment of SCI using a rodent SCI model. Our proposed biomaterial scaffolds that mimic the properties of the natural microenvironment can be promising candidates for stem cell-based tissue engineering. Considering the difficulties of generating a robust population of functional neurons and enhancing neuronal behaviors (neurite outgrowth and axon regeneration), our biodegradable hybrid nano-scaffold can serve as a powerful tool for achieving an improved SCI treatment.

2017 RESEARCH GRANT AWARDS - PILOT RESEARCH GRANT RECIPIENTS

Below is a project summary of the Individual Research Grant recipients:

CSCR17IRG007 - \$600,000

Stella Elkabes, Ph.D.

Rutgers University Biomedical Health Sciences

205 South Orange Avenue

Cancer Center F1204

Newark, NJ 07103

973-972-5163

elkabest@njms.rutgers.edu

Project Title: *The Astroglial Response to SCI: Modulation by a TLR9 Antagonist*

The effects of a TLR9 inhibitor on astrocyte function at the glial scar are investigated in mice sustaining a SC contusion injury and the underlying mechanisms are delineated in astrocyte cultures. Spinal cord trauma causes extensive tissue and cell loss at the affected site, disrupts the axons of nerve cells that mediate the communication between the brain and other parts of the body, and leads to permanent deficits including paralysis. Many molecular and cellular perturbations occur at the injury site, which worsen the damage caused by the initial trauma. A cell type found in the spinal cord, called astrocyte, responds to injury by altering its function. Astrocytes are the most abundant cells of the central nervous system and play many essential roles in both health and disease. Following injury, astrocytes divide, accumulate around the lesion and become an essential component of a scar that separates the healthy tissue from the wounded region in order to contain the damage and prevent further harm. However, this scar also constitutes a barrier to the repair of injured axons, partly because astrocytes release molecules that inhibit axonal growth. In addition, astrocytes promote the expansion of the inflammatory reaction at the injury site by secreting factors that attract inflammatory cells. Paradoxically, astrocytes protect nerve cells from death and support the viability of cells spared by the initial trauma. Given the multitude of important roles played by astrocytes following spinal cord injury (SCI), it is critical to understand how they change their function in response to trauma and to discover new approaches that enhance their beneficial effects while reducing their deleterious influences.

Encouraging preliminary investigations have shown that astrocyte function can be altered by a pharmacological inhibitor of toll like receptor 9 (TLR9). Toll like receptors (TLRs) are important components of the immune system but are also found in cells of the spinal cord and the brain. They mediate the response of the body to infection and to injury or diseases

that occur in the absence of infectious agents. TLRs play various roles following SCI, including regulation of the inflammatory reaction at the affected site. In accordance with this idea, earlier studies in this laboratory have shown that a TLR9 inhibitor reduces the number of inflammatory immune cells that infiltrate the injury epicenter and limits the development of chronic pain and bladder dysfunction associated with SCI. Even though TLR9 is found in astrocytes, it is not yet known how it influences astrocyte function at the scar.

The studies proposed in the present application will investigate how treatment with the TLR9 inhibitor changes the beneficial and detrimental functions of astrocytes at the scar, in mice sustaining a severe spinal cord contusion injury. In addition, studies will be performed to elucidate the underlying mechanisms by utilizing models that mimic injury in spinal cord astrocytes grown in dishes. The alteration of astrocyte function by the TLR9 inhibitor, could modify the properties of the scar, leading to improved axonal repair and protection of nerve cells. The discovery of new agents that can simultaneously enhance the restorative effects of astrocytes while attenuating the actions that hamper recovery could alleviate the devastating outcomes of SCI.

2017 RESEARCH GRANT AWARDS - PILOT RESEARCH GRANT RECIPIENTS

Below are the project summaries of the Exploratory Research Grant recipients:

CSCR17ERG007 - \$200,000

Eunsung Junn, Ph.D.

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Project Title: *Effect of microRNA-7 in Spinal Cord Injury*

We plan to investigate the potential therapeutic effect of microRNA-7 in a mouse model of spinal cord injury. A spinal cord injury is the damage to the spinal cord, which causes permanent changes in strength, sensation and other body functions below the site of the injury. In the United States, the occurrence of spinal cord injury has been estimated to be about 40 cases per 1 million people per year or around 12,000 cases per year. Currently, there are no effective therapies for the treatment of spinal cord injury. The first mechanical damage initiates a complex set of secondary molecular events that largely determine the symptoms of the spinal cord injury (SCI). Diverse cellular mechanisms responsible for this secondary injury mostly depend on changes of specific gene programs.

Since the first discovery in worm in 1993, microRNA (miR)-dependent gene regulation has been widely studied in a variety of eukaryotic organisms. MiRs are a class of 20-25 base-long RNAs that negatively regulate gene expression by binding to their target RNA sequence. Accumulating evidence suggest its key role in the pathogenesis of various diseases. Our published and preliminary data showed that microRNA-7 (miR-7) exhibits a protective role in the cellular models of oxidative stress. In particular, miR-7 accomplishes neuroprotection by improving the health of mitochondria, a powerhouse in the cells. Mitochondrial activity is severely compromised following spinal cord injury, thus improving mitochondrial health could have therapeutic value for the treatment of spinal cord injury. In the current application, we propose to investigate whether miR-7 promotes the functional recovery from spinal cord injury using a mouse model. MiR-7 will be delivered to injury sites using viral vector and gold nanoparticle, and its effect on locomotor behavior and cellular response will be assessed at 6 weeks post-delivery. We expect that miR-7 presents better motor functional recovery from the severe spinal cord compression, and that miR-7 can be developed as a potential therapeutic for spinal cord injury.

2017 RESEARCH GRANT AWARDS - PILOT RESEARCH GRANT RECIPIENTS

Below are the project summaries of the Exploratory Research Grant recipients:

CSCR17ERG005 - \$200,000

Bonnie Firestein, Ph.D.

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Project Title: *Targeting Cypin for Neural Circuit & Motor Function Recovery Following Spinal Cord Injury*

We will use drugs that target the protein cypin to promote nerve cell signaling and motor function after SCI. Spinal cord injury (SCI) causes widespread neuronal damage and dysfunction, often leading to severe motor deficits, which impair lives of affected individuals. The process of neuronal damage following SCI involves rapid release of glutamate from injured neurons, which causes further damage. Our group and others have shown that uric acid, a compound that naturally occurs in the body, promotes survival of neurons after they are injured. We have identified a handful of drugs that activate enzymes in the brain that produce uric acid. We have shown that these compounds help other types of neurons function after injury when the neurons are treated in a culture system.

We now propose to move our studies into the intact animal using a spinal cord contusion injury model. The value of such a study would be considerable, as it could provide information that could ultimately be used to influence neuronal survival after spinal cord insult in a way that could enhance motor function and the outcome of rehabilitative training after spinal cord injury. Thus, our hope is to develop novel therapies to cure paralysis after spinal cord injury.

2017 RESEARCH GRANT AWARDS - PILOT RESEARCH GRANT RECIPIENTS

Below are the project summaries of the Exploratory Research Grant recipients:

CSCR17ERG006 - \$200,000

Martin Yarmush, Ph.D.

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Project Title: *Pulsed Electric Fields for Spinal Cord Injury Wound Treatment*

The current studies will investigate the efficacy of pulsed electric fields as a multi-modal SCI treatment for pressure wound healing and infection control.

Pressure ulcer treatment has emerged as a particularly confounding medical problem, with an annual cost of over \$11 billion per year in the US. Spinal cord injury patients are particularly susceptible to pressure wound development with an incidence of over 50% and there are approximately 400 new patients per year who suffer from spinal cord injury in New Jersey. Among the factors that specifically increase spinal cord injured patient risk is loss of sensation and mobility, resulting in unrelieved pressure on tissues over bony structures, reduced micro-circulation and ultimately tissue necrosis.

A second but major consequence of pressure ulcers is bacterial colonization within the wound which can result in sepsis and patient death. The fact that normal wound healing is compromised in spinal cord injured patients, further complicates patient treatment and increases risk of infection. However, with the emergence of antibiotic resistance strains, antibiotic treatment may be problematic especially in patients who suffer from repeated pressure wound and infection cycles. Therefore, finding an effective pressure wound treatment for spinal cord injury patients will help to resolve a very large problem associated with both patient mortality and growing financial costs.

We believe that pulsed electric fields can be used as a multi-modal treatment for spinal cord injury patients to 1) improve pressure wound closure and 2) prevent bacterial overgrowth in the wounds thereby reducing patient morbidity and mortality. Given our recent success in applying this technology to burn wound injury treatment, the proposed studies will determine whether this approach can also be used to treat pressure wounds and

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their infections following spinal cord injury. However, since spinal cord injury also compromises normal wound healing, the challenge of this exploratory proposal will be to test and/or optimize our technology for pressure wound and bacterial control following spinal cord injury in a mouse model. The development of a chemical-free, relatively low cost, multi-targeted therapy for SCI pressure wound healing and disinfection will be a major and significant step forward in this field.

2017 RESEARCH GRANT AWARDS - PILOT RESEARCH GRANT RECIPIENTS

Below are the project summaries of the Exploratory Research Grant recipients:

CSCR17ERG010 - \$200,000

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Project Title: *Multi-Scale Modeling of Dynamic Behavior of White Matter*

We will characterize how individual axons respond to dynamic loading in situ and use this information to significantly expand and enhance a multi-scale computational model of white matter mechanics. Spinal Cord Injury (SCI) begins with mechanical trauma that deforms and damages tissue. This mechanical injury leads to a series of secondary injuries, which begin to develop minutes after injury and can continue to damage cells for weeks. Although these secondary injuries are the main target for clinical therapies, the devastating consequences of SCI are best avoided by preventing the primary injury. To rationally design means and develop measures to avert these injuries, to understand the severity and extent of primary SCI and relate it to secondary injury, and to develop reproducible and relevant in vivo and in vitro models of SCI, a thorough and complete understanding of the mechanics of the tissue is required. The mechanics are complicated because spinal cord tissue is not a “solid” in the traditional sense. It is composed of cells and other microscopic entities that combined give it properties at a much larger scale. However, it is these microscopic entities that are damaged and are responsible for the loss of physiological functions. In particular, damage to axons in the white matter of the spinal cord is the largest contributor to physiological and functional deficits following SCI. An axon is the part of the neuron that connects it to the next neuron or the end target, such as a muscle. Thus, when axons are damaged, signals from the brain to the periphery and from the periphery back to the brain cannot be propagated.

White matter is primarily composed of bundles of these axons and cells that wrap a fatty substance called myelin around the axons. The myelin acts as an insulator to improve the speed of electrical signals similar to insulation around a wire. We have shown that these myelinating cells, which are called oligodendrocytes, also mechanically couple axons together and change the mechanical behavior of the tissue. We have also developed an approach to study the multi-scale mechanics of white matter in situ – that is, how the

2017 RESEARCH GRANT AWARDS - PILOT RESEARCH GRANT RECIPIENTS

individual axons in their natural state stretch when the whole tissue is stretched, and how this relationship is influenced by oligodendrocytes – and we have incorporated the information into a computer model of this multi-scale behavior. However, our previous characterizations and models have some significant limitations that we aim to address in this proposal. First, and most importantly, we developed the model from data collected after stretching spinal cord samples very slowly. However, trauma in SCI occurs very quickly – on the order of a few milliseconds – and we know that the mechanical response of the axons is different when they are stretched quickly and slowly. We will develop an innovative approach using flash-freezing to capture the changes in axons that occur when stretched very quickly. Second, we previously identified strain thresholds above which an axon would break based on complete mechanical failure of axons, but we know that an axon will functionally fail before it completely physically fails. We will characterize disruptions in the axonal cytoskeleton following dynamic stretch. Finally, we have determined strain thresholds for axons, but some evidence suggests that axons may be more sensitive to mechanical stress than strain. To study stress at the axon level, we will determine the mechanical properties of individual axons in situ when myelinated and not myelinated. Then we will incorporate these properties and the dynamic characterizations into our computer model of white matter mechanics. This model will allow us to study how stress and strain are distributed among axons when the tissue experiences dynamic mechanical loads, and how the stress and strain are redistributed once axons begin to fail. This model can then be used to identify the circumstances that cause SCI, to assess the extent and severity of primary axon injury in these circumstances, and to rationally design and develop approaches to prevent these circumstances.

2017 RESEARCH GRANT AWARDS - PILOT RESEARCH GRANT RECIPIENTS

Below are the project summaries of the Spinal Cord Techniques Training Travel Grant recipients:

CSCR17TTT008 - \$4,000

Kathlyn Laval, Ph.D.

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The aim of the applicant NJCSCR project is to set up a new animal model of neuropathic itch. By characterizing the cellular and molecular mechanisms of neuropathic pruritus induced in mice by pseudorabies (PRV), an alphaherpesvirus, the applicant will determine whether virus-induced inflammation and damage of peripheral nervous system (PNS) neurons and spinal cord contribute to the development of neuropathic itch symptoms. This research will provide a better understanding of how viral-induced damage to the PNS and spinal cord produces neuropathic itch in mammals.

In this context, attending the spinal cord injury course will be a unique opportunity for the applicant to learn new techniques which have the potential to widen the scope and practical applicability of her research project considerably. Such a course will also allow the applicant to interact with experts in the field, foster collaborations, and will also be a source of new ideas and approaches. The scientific and leadership training founded by this application will provide a solid foundation to increase the likelihood of successful appointment of the applicant to a tenure-track academic faculty position working on the pathogenesis of neurotropic viruses with a particular interest in clinical applications of these findings in SCI research.

2017 RESEARCH GRANT AWARDS - PILOT RESEARCH GRANT RECIPIENTS

Below are the project summaries of the Spinal Cord Techniques Training Travel Grant recipients:

CSCR17TTT009 - \$4,000

Sinan Gok, Ph.D.

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I am a Ph.D. candidate in the Department of Biomedical Engineering at New Jersey Institute of Technology. I have been working on the “Chronic recordings from the descending pathways of rat spinal cord” project for about five years now. I am currently investigating the correlations between the forelimb muscle activities and descending neural signals in behaving rats. My initial findings, which were presented in various conferences, show that forelimb EMG signals can be accurately predicted using the neural data that was recorded during a reach-to-pull task. I have been using a custom made ECoG-type electrode array to record this data. However, there is still plenty of room for improvement in terms of insertion techniques, signal quality and selectivity. In order to address many challenges that I have faced with the current electrode, I am proposing to use a new recording electrode, namely, carbon fiber multi-electrodes (CFMEs). CFMEs are made of very small caliber carbon fiber filaments (5-7 μm) with small footprints which make them attractive for neural recordings. However, the implantation procedure will be very challenging. Learning new surgical techniques and sharing hands-on experiences with other colleagues will surely help me to improve the success of my experiments.

I have been trained by Dr. Mesut Sahin, one of the experts in rat spinal cord surgery for chronic electrode implants. Innovative techniques that were developed by Dr. Sahin allowed us to collect long-term data from freely moving rats. As his assistant in surgeries, I took part in preparing the animals for surgery, monitoring the vitals during operation, and making incisions for electrode implants. I have gained skills on epimysial EMG wire placement and dorsal laminectomy. I have also had experience with brain craniotomy for neural stimulation. I believe that my field of study is strongly correlated with the Ohio State University’s SCI Research Training Program. The objectives of the program including to teach proficiency in spinal cord laminectomy, post-operative care, behavioral assessment of locomotor function, to provide hands-on experience with rodent injury models and surgical approaches can greatly help me to improve my experimental skills.

2017 RESEARCH GRANT AWARDS - PILOT RESEARCH GRANT RECIPIENTS

Below are the project summaries of the Spinal Cord Techniques Training Travel Grant recipients:

CSCR17TTT007 - \$4,000

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My laboratory focuses on understanding the underlying mechanisms of central nervous system (CNS) injury emphasizing spinal cord injury (SCI) mediated neurological dysfunctions with the objective of developing effective therapeutic strategies. Our primary focus is on unraveling the inter/intracellular signaling pathways and role of various regulatory factors involved in neuronal/axonal regeneration in the CNS after injuries. We use in vivo model of hemisection SCI and in vitro stretch injury model to elucidate the mechanisms of injury to locate target mechanism to develop therapeutic strategies against CNS injury. In addition, we employ various other in vitro and in vivo research approaches, including blocking of repulsive signaling pathways using pharmacological methods, virus vector-mediated gene transfer to the SCI site and brain, survival animal surgeries etc. Now I am looking forward the opportunities to expand my research sphere by incorporating more relevant techniques and models of CNS injuries.

Currently, we are focusing on effective therapeutic interventions targeting the major mechanisms of axonal regeneration for developing clinical methods for SCI patients. There are several intrinsic factors including phosphatase and tensin homolog (PTEN), phosphatidylinositol 3-kinase (PI3K), suppressor of cytokine signaling 3 (SOCS3) and protein tyrosine phosphatase (PTP) that controls axonal regeneration by controlling gene expression after CNS injury. It is well established that PTEN, a negative regulator of mammalian target of rapamycin (mTOR), appears to be particularly important for controlling the regenerative capacity of injured axons after CNS injury. Conditional deletion of PTEN remarkably enhances axon growth after SCI or optic nerve injury (ONI). Recently, we reported that PTEN antagonists peptides enhances axonal regeneration and promotes functional recovery after SCI in mice. PTEN inhibition potentiates axonal sprouting in ONI and SCI through induction of PI3K/Akt signaling and activation of mTOR. Similar to PTEN, suppressor of cytokine signaling 3 (SOCS3, a negative regulator of Janus kinase/signal transducers and activators of transcription (JAK/STAT) pathway) has a significant role in regulating axonal regeneration after CNS injury. In another

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pathway, the chondroitin sulfate proteoglycans (CSPGs) inhibit neuronal growth by binding and activating two PTP receptors, PTP σ and LAR. Intracellularly, activation of PTP σ and LAR by CSPGs activate RhoA-Rock signaling and inactivate Akt and Erk pathways. Recent investigations have revealed the prospects of growth promoting/differentiating signaling proteins as therapeutic agents against SCI conditions. We will enhance the level of these growth-promoting/differentiating factors by introducing the gene via lentivirus vector tailored with a highly efficient promoter and green fluorescent protein (GFP) into sensori-motor cortex of brain and to the sites of hemisection SCI (rostral to the lesion) of injured mice and evaluate their role in promoting axonal regeneration. Therapeutic approaches using gene therapy have been reported in various animal models of different CNS injuries including traumatic brain injury (TBI), SCI and ONI. In vivo gene delivery to the sites of SCI has been useful in identifying patterns of axonal sensitivity to growth factors both in acute and chronic SCI. It also directs long-term transgene expression in neurons and glial cells and this allows us to perform long-term functional recovery studies to investigate the efficacy of cell and gene-based repair strategies.

From the Spinal Cord Injury Techniques Training Grant, I am anticipating an extensive exposure to various techniques and methods in SCI in the form of features lectures, demonstrations, and hands-on experience in all facets of spinal cord injury research, as well as training in surgery, animal care, behavioral studies, and outcome measures. This training will help me to closely interact with the pioneers in SCI and improve my understanding of spinal cord injury and strengthen my research. In addition, this training will allow me to apply my gene therapy expertise to spinal cord research more effectively, so that I can conduct innovative and effective research to develop therapeutic strategies against spinal cord injury.

ATTACHMENT A SPINAL CORD RESEARCH ACT

ATTACHMENT A

Spinal Cord Research Act

CHAPTER 201

An Act establishing a New Jersey Commission on Spinal Cord Research, supplementing Title 52 of the Revised Statutes and amending R.S.39:5-41.

Be It Enacted *by the Senate and General Assembly of the State of New Jersey:*

C.52:93E-1 Short title.

1. This act shall be known and may be cited as the “Spinal Cord Research Act.”

C.52:93E-2 Definitions relative to spinal cord research.

2. As used in this act:

a. “Approved research project” means a peer reviewed scientific research project, which is approved by the commission and which focuses on the treatment and cure of spinal cord injuries and diseases that damage the spinal cord.

b. “Commission” means the New Jersey Commission on Spinal Cord Research established pursuant to this act.

c. “Institutional support services” means all services, facilities, equipment, personnel and expenditures associated with the creation and maintenance of approved research projects.

d. “Qualifying research institution” means the University of Medicine and Dentistry of New Jersey; Rutgers, The State University; Princeton University; the Kessler Medical Rehabilitation Research and Education Corporation; the Coriell Institute for Medical Research; and any other research institution in the State approved by the commission.

C.52:93E-3 New Jersey Commission on spinal Cord Research.

3. a. There is established in the Executive Branch of the State government, the New Jersey Commission on Spinal Cord Research. For the purposes of complying with the provisions of Article V, Section IV, paragraph 1 of the New Jersey Constitution, the commission is allocated within the Department of Health and Senior Services, but notwithstanding that allocation, the commission shall be independent of any supervision or control by the department or by any board or officer thereof.

ATTACHMENT A SPINAL CORD RESEARCH ACT

b. The commission shall consist of 11 members, including the Commissioner of Health and Senior Services, or his designee, who shall serve ex officio; one representative of the University of Medicine and Dentistry of New Jersey; one representative of Rutgers, The State University; one representative of the federally designated Spinal Cord Injury Model System; one representative from the American Paralysis Association; and six public members who are residents of the State knowledgeable about spinal cord injuries and who include at least one physician licensed in this State and at least one person with a spinal cord injury. The members shall be appointed by the Governor with the advice and consent of the Senate.

c. The term of office of each appointed member shall be three years, but of the members first appointed, three shall be appointed for a term of one year, four for terms of two years, and three for terms of three years. All vacancies shall be filled for the balances of the unexpired terms in the same manner as the original appointments. Appointed members are eligible for reappointment upon the expiration of their terms. A member shall continue to serve upon the expiration of his term until a successor is appointed.

The members of the commission shall not receive compensation for their services, but shall be reimbursed for the actual and necessary expenses incurred in the performance of their duties as members of the commission.

C.52:93E-4 Responsibilities of commission.

4. The commission shall:

a. Review and authorize approved research projects, for which purpose the commission may establish an independent scientific advisory panel composed of scientists and clinicians who are not members of the commission to review proposals submitted to the commission and make funding recommendations to the commission;

b. Apportion all available funds to qualifying research institutions to finance approved research projects and necessary institutional support services;

c. Ensure that funds so apportioned to approved research projects are not diverted to any other use;

d. Take steps necessary to encourage the development within the State of spinal cord research projects;

e. Compile a directory of all spinal cord research projects being conducted in the State; and

f. Provide the Governor and the Legislature with a report by January 30 of each year describing the status of the commission's activities and the results of its funded research efforts.

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C.52:93E-5 Authority of commission.

5. The commission is authorized to:

- a. Adopt rules and regulations concerning the operation of the commission, the functions and responsibilities of its officers and employees and other matters as may be necessary to carry out the purposes of this act;
- b. Maintain offices at such places within the State as it may designate;
- c. Employ an executive director and other personnel as may be necessary, whose employment shall be in the unclassified service of the State, except that employees performing stenographic or clerical duties shall be appointed pursuant to Title 11A (Civil Service) of the New Jersey Statutes;
- d. Design a fair and equitable system for the solicitation, evaluation and approval of proposals for spinal cord research projects;
- e. Apply for and accept any grant of money from the federal government, which may be available for programs relating to research on the spinal cord;
- f. Enter into contracts with individuals, organizations and institutions necessary or incidental to the performance of its duties and the execution of its powers under this act; and
- g. Accept gifts, grants and bequests of funds from individuals, foundations, corporations, governmental agencies and other organizations and institutions.

C.52:93E-6 Election, duties of officers.

6. The commission shall annually elect a chairman and a vice-chairman from among its members. The chairman shall be the chief executive officer of the commission, shall preside at all meetings of the commission and shall perform other duties that the commission may prescribe.

The executive director shall serve as secretary to the commission and shall carry out its policies under the direction of the chairman.

C.52:9E-7 Direct application for funds permitted.

7. Nothing in this act shall preclude a qualifying research institution or any other research facility in the State from directly applying for or receiving funds from any public or private agency to conduct spinal cord research.

ATTACHMENT A SPINAL CORD RESEARCH ACT

C.52:93E-8 Establishment, maintenance of central registry.

8. a. The commission shall establish and maintain, in conjunction with the Department of Health and Senior Services, a central registry of persons who sustain spinal cord injuries other than through disease, whether or not the injury results in a permanent disability, in order to provide a database that indicates the incidence and prevalence of spinal cord injuries and which will serve as a resource for research, evaluation and information on spinal cord injuries and available services.

b. The commission shall require the reporting of all cases of spinal cord injuries, except those caused through disease, and the submission of specified additional information on reported cases as it deems necessary and appropriate.

The commission shall, by regulation, specify the health care facilities and providers required to make the report of a spinal cord injury to the registry, information that shall be included in the report to the registry, the method for making the report and the time period in which the report shall be made.

c. The reports made pursuant to this section are to be used only by the commission and the Department of Health and Senior Services and such other agencies as may be designated by the commission or the department and shall not otherwise be divulged or made public so as to disclose the identity of any person to whom they relate; and to that end, the reports shall not be included under materials available to public inspection pursuant to P.L.1963, c.73 (C.47:1A-1 et seq.).

d. No individual or organization providing information to the commission in accordance with this section shall be deemed to be, or held liable for, divulging confidential information. Nothing in this section shall be construed to compel any individual to submit to medical, commission or department examination or supervision.

e. A health care facility or health care provider who is required to report a spinal cord injury to the commission that fails to comply with the provisions of this section shall be liable to a penalty of up to \$100 per unreported spinal cord injury case. A penalty sued for under the provisions of this section shall be recovered by and in the name of the commission and shall be deposited in the “New Jersey Spinal Cord Research Fund” established pursuant to this act.

C.52:93E-9 “New Jersey Spinal Cord Research Fund.”

9. a. There is established in the Department of the Treasury a nonlapsing revolving fund to be known as the “New Jersey Spinal Cord Research Fund.” This fund shall be the repository for moneys provided pursuant to subsection e. of R.S.39:5-41. Moneys deposited in the fund, and any interest earned thereon, shall be used exclusively for the purpose of making grants for approved spinal cord research projects at qualified research institutions.

ATTACHMENT A SPINAL CORD RESEARCH ACT

b. Any costs incurred by the department in the collection or administration of the fund may be deducted from the funds deposited therein, as determined by the Director of the Division of Budget and Accounting.

10. R.S.39:5-41 is amended to read as follows:

Fines, penalties; forfeitures, disposition of; exceptions.

39:5-41. a. All fines, penalties and forfeitures imposed and collected under authority of law for any violations of R.S.39:4-63 and R.S.39:4-64 shall be forwarded by the judge to whom the same have been paid to the proper financial officer of a county, if the violation occurred within the jurisdiction of that county's central municipal court, established pursuant to N.J.S.2B:12-1 et seq. or the municipality wherein the violation occurred, to be used by the county or municipality to help finance litter control activities in addition to or supplementing existing litter pickup and removal activities in the municipality.

b. Except as otherwise provided by subsection a. of this section, all fines, penalties and forfeitures imposed and collected under authority of law for any violations of the provisions of this Title, other than those violations in which the complaining witness is the director, a member of his staff, a member of the State Police, a member of a county police department and force or a county park police system in a county that has established a central municipal court, an inspector of the Board of Public Utilities, or a law enforcement officer of any other State agency, shall be forwarded by the judge to whom the same have been paid as follows: one-half of the total amount collected to the financial officer, as designated by the local governing body, of the respective municipalities wherein the violations occurred, to be used by the municipality for general municipal use and to defray the cost of operating the municipal court; and one-half of the total amount collected to the proper financial officer of the county wherein they were collected, to be used by the county as a fund for the construction, reconstruction, maintenance and repair of roads and bridges, snow removal, the acquisition and purchase of rights-of-way, and the purchase, replacement and repair of equipment for use on said roads and bridges therein. Up to 25% of the money received by a municipality pursuant to this subsection, but not more than the actual amount budgeted for the municipal court, whichever is less, may be used to upgrade case processing.

All fines, penalties and forfeitures imposed and collected under authority of law for any violations of the provisions of this Title, in which the complaining witness is a member of a county police department and force or a county park police system in a county that has established a central municipal court, shall be forwarded by the judge to whom the same have been paid to the financial officer, designated by the governing body of the county, for all violations occurring within the jurisdiction of that court, to be used for general county use and to defray the cost of operating the central municipal court.

ATTACHMENT A SPINAL CORD RESEARCH ACT

Whenever any county has deposited moneys collected pursuant to this section in a special trust fund in lieu of expending the same for the purposes authorized by this section, it may withdraw from said special trust fund in any year an amount which is not in excess of the amount expended by the county over the immediately preceding three-year period from general county revenues for said purposes. Such moneys withdrawn from the trust fund shall be accounted for and used as are other general county revenues.

c. (Deleted by amendment, P.L.1993, c.293.)

d. Notwithstanding the provisions of subsections a. and b. of this section, \$1.00 shall be added to the amount of each fine and penalty imposed and collected under authority of any law for any violation of the provisions of Title 39 of the Revised Statutes or any other motor vehicle or traffic violation in this State and shall be forwarded by the person to whom the same are paid to the State Treasurer. In addition, upon the forfeiture of bail, \$1.00 of that forfeiture shall be forwarded to the State Treasurer. The State Treasurer shall annually deposit those moneys so forwarded in the "Body Armor Replacement" fund established pursuant to section 1 of P.L.1997, c.177 (C.52:17B-4.4). Beginning in the fiscal year next following the effective date of this act, the State Treasurer annually shall allocate from those moneys so forwarded an amount not to exceed \$400,000 to the Department of Personnel to be expended exclusively for the purposes of funding the operation of the "Law Enforcement Officer Crisis Intervention Services" telephone hotline established and maintained under the provisions of P.L.1998, c.149 (C.11A:2-25 et al.).

e. Notwithstanding the provisions of subsections a. and b. of this section, \$1 shall be added to the amount of each fine and penalty imposed and collected under authority of any law for any violation of the provisions of Title 39 of the Revised Statutes or any other motor vehicle or traffic violation in this State and shall be forwarded by the person to whom the same are paid to the State Treasurer. The State Treasurer shall annually deposit those moneys so forwarded in the "New Jersey Spinal Cord Research Fund" established pursuant to section 9 of P.L.1999, c.201 (C.52:9E-9). In order to comply with the provisions of Article VIII, Section II, paragraph 5 of the State Constitution, a municipal or county agency which forwards moneys to the State Treasurer pursuant to this subsection may retain an amount equal to 2% of the moneys which it collects pursuant to this subsection as compensation for its administrative costs associated with implementing the provisions of this subsection.

C.52:93E-10 Rules, regulations pertinent to spinal cord research.

11. The commission shall adopt such regulations pursuant to the "Administrative Procedure Act," P.L.1968, c.410 (C.52:14B-1 et seq.) as are necessary to carry out the provisions of this act.

12. This act shall take effect on the 90th day following enactment.

Approved September 13, 1999.

ATTACHMENT B NEW JERSEY SPINAL CORD INJURY REGISTRY

ATTACHMENT B

New Jersey Spinal Cord Injury Surveillance System

The following tables summarize data collected on spinal cord injury in New Jersey.

All spinal cord injury inpatient hospitalizations, New Jersey residents, 2013-2016

Groups	2013			2014			2015 Q1-Q3			2015 Q4			2016		
	Trauma	Acute	Total	Trauma	Acute	Total	Trauma	Acute	Total	Trauma	Acute	Total	Trauma	Acute	Total
Males	234	99	333	232	110	342	175	50	225	75	14	89	248	63	311
Females	88	71	159	100	60	160	68	46	114	37	12	49	94	51	145
Under 15 years	10	0	10	7	2	9	6	0	6	2	0	2	8	0	8
15-24 years	30	4	34	42	3	45	22	0	22	10	0	10	36	2	38
25-34 years	38	5	43	34	5	39	28	2	30	15	0	15	33	1	34
35-44 years	36	10	46	33	13	46	25	5	30	15	2	17	36	6	42
45-54 years	56	39	95	53	26	79	37	12	49	21	1	22	49	16	65
55-64 years	41	23	64	50	32	82	40	22	62	16	9	25	64	23	87
65-74 years	38	25	63	45	30	75	42	22	64	11	7	18	53	24	77
75-84 years	34	37	71	36	28	64	24	23	47	13	3	16	43	23	66
85 years and older	39	27	66	32	31	63	19	10	29	9	4	13	20	19	39
White non-Hispanic	194	127	321	192	125	317	126	63	189	67	17	84	193	82	275
Black non-Hispanic	66	22	88	67	19	86	62	12	74	19	5	24	70	18	88
Native American	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1
Asian/Pacific Islander	7	7	14	9	6	15	5	7	12	3	1	4	14	4	18
Hispanic	37	10	47	40	10	50	30	9	39	15	3	18	33	8	41
Other or Unknown	17	4	21	24	10	34	18	5	23	8	0	8	31	2	33
Total	322	170	492	332	170	502	243	96	339	112	26	138	342	114	456

Hospitalized deaths of spinal cord injury patients, New Jersey residents, 2013-2016

Groups	2013			2014			2015 Q1-Q3			2015 Q4			2016		
	Total	Died	%	Total	Died	%	Total	Died	%	Total	Died	%	Total	Died	%
Males	333	29	8.7	342	32	9.4	225	21	9.3	89	3	**	311	30	9.6
Females	159	10	6.3	160	9	5.6	114	6	5.3	49	1	**	145	2	**
Under 15 years	10	0	-	9	2	**	6	0	-	2	0	-	8	0	-
15-24 years	34	0	-	45	2	**	22	2	**	10	0	-	38	0	-
25-34 years	43	5	11.6	39	2	**	30	0	-	15	0	-	34	3	**
35-44 years	46	1	**	46	4	**	30	3	**	17	0	-	42	1	**
45-54 years	95	5	5.3	79	0	-	49	2	**	22	0	-	65	1	**
55-64 years	64	3	**	82	7	8.5	62	2	**	25	1	**	87	6	6.9
65-74 years	63	4	**	75	5	6.7	64	3	**	18	0	-	77	9	11.7
75-84 years	71	9	12.7	64	4	**	47	7	14.9	16	1	**	66	7	10.6
85 years and older	66	12	18.2	63	15	23.8	29	8	27.6	13	2	**	39	5	12.8
White non-Hispanic	321	31	9.7	317	25	7.9	189	17	9.0	84	2	**	275	16	5.8
Black non-Hispanic	88	6	6.8	86	8	9.3	74	5	6.8	24	1	**	88	5	5.7
Hispanic	47	0	-	50	4	**	39	2	**	18	1	**	41	4	**
Total	492	39	7.9	502	41	8.2	339	27	8.0	138	4	**	456	32	7.0

ATTACHMENT B NEW JERSEY SPINAL CORD INJURY REGISTRY

Spinal cord injury hospitalizations discharge dispositions, New Jersey residents, 2013-2016

Outcome	2013		2014		2015 Q1-Q3		2015 Q4		2016	
	N	%	N	%	N	%	N	%	N	%
Total spinal cord injury hospitalizations	492	100	502	100	339	100	138	100	456	100
Hospitalized death	39	7.9	41	8.2	27	8.0	4	**	32	7.0
Discharge to another acute care facility	13	2.6	28	5.6	15	4.4	4	**	10	2.2
Discharge to skilled nursing facility	87	17.7	88	17.5	70	20.6	27	19.6	59	12.9
Discharge to home, home health aide	31	6.3	25	5.0	12	3.5	10	7.2	24	5.3
Discharge to rehabilitation	148	30.1	160	31.9	119	35.1	48	34.8	181	39.7
Discharge to other inpatient care	5	1.0	5	1.0	0	-	1	**	3	**
Left against medical advice	2	**	4	**	4	**	1	**	2	**
Other discharge dispositions	15	3.0	19	3.8	11	3.2	7	5.1	18	3.9
Discharge to home, routine discharge	152	30.9	132	26.3	81	23.9	36	26.1	127	27.9

Mechanism of spinal cord injury by year of hospitalizations and age group, New Jersey residents, 2013-2016

Mechanism	Age groups									
	<15 years		15-24 years		25-44 years		45-64 years		65+ years	
	N	%	N	%	N	%	N	%	N	%
Motor vehicle occupants**	2	**	7	18.4	13	17.1	15	9.9	12	6.6
Pedestrian (traffic and other)	0	-	2	**	3	**	5	3.3	5	2.7
Pedal cyclists (traffic and other)	0	-	0	-	0	-	3	**	1	**
Motorcyclists	0	-	1	**	5	6.6	4	**	0	-
Unspecified MV position***	1	**	1	**	3	**	4	**	4	**
Other transport vehicles	0	-	3	**	0	-	3	**	1	**
Falls	2	**	9	23.7	21	27.6	71	46.7	120	65.9
Struck by/against	2	**	1	**	1	**	5	3.3	2	**
Assault	0	-	5	13.2	5	6.6	3	**	0	-
Self-inflicted	0	-	0	-	3	**	0	-	0	-
All other unintentional injuries	1	**	6	15.8	12	15.8	11	7.2	11	6.0
All other & unspecified injuries	0	-	3	**	10	13.2	28	18.4	26	14.3
Total	8	100	38	100	76	100	152	100	182	100

Notes for all tables:

- Inpatient hospitalizations for spinal cord injuries for New Jersey residents selected according to bill type in the NJ Hospital Discharge Data System.
- Given the limitations of trend analysis across the ICD-9-CM and ICD-10-CM transition and appropriate population estimates, data have been analyzed per 1,000 hospitalizations in the respective quarter.
- Rates are calculated per 100,000 population and are either age-specific or age-adjusted using the 2000 US Standard Population.
- Rates are not calculated for fewer than 20 observations, percents not calculated for fewer than 5 observations, denoted by **.
- Races are as reported. Hispanics can be of any race.

Data sources: New Jersey Central Nervous System Injury Surveillance data; NCHS Bridged Race Estimates for population.

Case definition ICD-9-CM: 806.0-806.9; 952.0-952.9

Case definition ICD-10-CM: S14.0, S14.1, S24.0, S24.1, S34.0, S34.1, S34.3 and encounter code not 'S' (sequelae)

Source (all tables) New Jersey Central Nervous System Injury Surveillance data, 2003-2016
 Center for Health Statistics and Informatics
 Population Health Division
 New Jersey Department of Health
 November 20, 2018