

**NEW JERSEY COMMISSION ON
SPINAL CORD RESEARCH**



2012 ANNUAL REPORT

JANUARY 30, 2013



January 30, 2013

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

Dear Governor Christie:

On behalf of the New Jersey Commission on Spinal Cord Research (NJCSCR), its members, staff and the spinal cord injured citizens of New Jersey; it is my privilege to present the Annual Report for Fiscal Year 2012, pursuant to N.J.S.A. 52:9E-4(f).

In 2012 the NJCSCR awarded nearly \$2.3 million, funding four Individual Research Grants totaling \$2,048,579, two Spinal Cord Injury Techniques Training Travel Grants totaling \$3,500, and two Fellowships totaling \$210,000. These projects were carefully selected by a panel of independent scientific experts from 31 applications submitted by researchers at New Jersey academic institutions, and approved by vote of the NJCSCR.

The NJCSCR grants often produce the basic research findings necessary to compete successfully for larger NIH and other awards, and help attract talented scientists and students to this exciting and promising field. Each of the funded projects has the potential to contribute significantly to the development of treatments and cures for the paralysis and complications that accompany spinal cord injury.

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

Respectfully,

Susan P. Howley
Chairperson



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2012 COMMISSION MEMBERS

Susan P. Howley, Chairperson
Cynthia M. Kirchner, M.P.H, Vice-Chair
Peter W. Carmel, M.D.
Robin L. Davis, Ph.D.
John D. Del Colle
James McCormack

ACKNOWLEDGEMENTS

The NJCSCR would like to express its sincere appreciation to all present and past Commission members, and to the New Jersey Department of Health for their expertise, time, and effort.

The NJCSCR also wishes to thank the Center for Health Statistics, Department of Health for the spinal cord injury surveillance statistics, and Commission staff members Christine Traynor and Mary Ray for their support.

This report is being submitted in fulfillment of the legislative mandate in the *N.J.S.A. 52:9E-4(f)*. The report describes the implementation of the Spinal Cord Research Act and evaluates the benefit of the Act as evidenced in this report of grant awards for State Fiscal Year 2012.

ADMINISTRATIVE STAFF

Christine Traynor, Administrator
Mary Ray, Fiscal Manager

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EXECUTIVE SUMMARY

The New Jersey Commission on Spinal Cord Research, established in 1999, funds spinal cord injury research projects in New Jersey.

- ❖ ***Since 2001, the New Jersey Commission on Spinal Cord Research (NJCSCR) has awarded over \$35 million to individual scientists at six academic and research institutions, and approved 167 separate scientific research projects.***
 - *Since 2001, 132 NJCSCR scientific research projects have been completed.*
 - *Progress made by NJCSCR researchers has been presented in abstracts, scientific conferences, symposia, and meetings.*
 - *NJCSCR programs have enabled wider scientific interaction and numerous active research collaborations, many with out-of-state researchers.*
 - *Success in achieving NJCSCR funding has resulted in academic and career advancement for New Jersey researchers, including doctoral dissertations.*
 - *Over 50 applications to NIH, NSF and other organizations based on NJCSCR grants have been made.*

- ❖ ***NJCSCR offered four grant programs in Fiscal Year 2012:***
 - *Individual Research Grants*
 - *Exploratory Research Grants*
 - *Postdoctoral and Graduate Fellowship Grants*
 - *Spinal Cord Injury Techniques Training Travel Grants*

- ❖ ***NJCSCR 2012 Achievements:***
 - *Thirty-one applications requesting \$9.2 million were submitted.*
 - *Eight awards were made in 2012 totaling \$2,262,079.*
 - *Three Individual Research Grants totaling \$2,048,579, two Fellowships totaling \$210,000, and two Spinal Cord Injury Techniques Training Travel Grants totaling \$3,500 were approved.*

NJ Spinal Cord Registry:

- ❖ *NJCSCR supports a central registry of spinal cord injured persons in New Jersey in cooperation with New Jersey Department of Health's Center for Health Statistics.*
- ❖ *The registry database provides resource for research, evaluation, and information on spinal cord injuries.*
- ❖ *All Level 1 trauma centers now collect and submit comprehensive data electronically and soon an on-line system will allow all New Jersey acute care facilities to participate.*



INTRODUCTION



Spinal cord injury and paralysis has long been regarded as a virtually hopeless diagnosis with a grim prognosis. Only since World War II has the outlook brightened. New approaches to rehabilitation and modern medicines have extended life expectancy from mere months to years and even decades.

Many people with permanent injury now look forward to far more vital and productive lives. More recently, breakthroughs in research and new horizons in the life sciences are moving us closer towards finding cures for spinal cord injuries. This prospect is, however, not yet a reality.

Facts and Figures

- Approximately 6,000 New Jersey residents suffer from traumatic injuries or diseases that damage the spinal cord.
- Nationally, the number of people living with a spinal cord injury totals 1,275,000.*
- Individual medical costs can easily exceed tens or even hundreds of thousands of dollars per year – lifetime costs can be in the millions.
- Nationally, the cost of spinal cord injuries are estimated at \$40.5 billion.*
- Indirect costs are hard to quantify, but place a significant burden on individuals and their families, and on state and local resources. The toll in emotional costs and quality of life is incalculable.

*Source: *One Degree of Separation – Spinal Cord Injury and Paralysis in the United States*. Christopher & Dana Reeve Foundation, 2009

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 spinal cord injury is increasing. Falls, traffic and worksite accidents are the major causes of injuries. Black and Hispanic populations suffer disproportionately.

The economic and human costs of these injuries remain huge. Better therapies are urgently 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.



NEW JERSEY'S COMMITMENT TO SPINAL CORD RESEARCH

The Spinal Cord Research Act (N.J.S.A. 52:9e-1 et seq.) created the New Jersey Commission on Spinal Cord Research and the New Jersey Spinal Cord Research Fund to support its activities.

New Jersey is a leader in supporting the quest for a cure and repair of spinal cord injuries and paralysis. The New Jersey Commission on Spinal Cord Research, created in 1999 under New Jersey's Spinal Cord Research Act, represents the successful culmination of years of determined effort to enlist New Jersey in the fight.

The NJCSCR provides research grant programs for both established scientists and younger researchers committed to the goals of spinal cord injury research. The Commission also supports the New Jersey Department of Health (NJDOH), Center for Health Statistics ("CHS") in establishing a database of all spinal cord injured patients in New Jersey.

Now in its 13th year of operation, the NJCSCR has funded 167 scientific research projects and supported individual scientists at research institutions around the state. Its impartial and scientifically rigorous application and review process has helped make the NJCSCR vital to New Jersey's best researchers in their pursuit of answers and cures.

THE NEW JERSEY COMMISSION ON SPINAL CORD RESEARCH

The NJCSCR is one of only nine publicly-funded organizations nationwide that, together with the National Institutes of Health, the Centers for Disease Control, the Veterans' Administration and a few other entities, provide the essential support for the research and learning needed to find the long-sought-for solutions for this devastating and so far incurable injury.

Created as a semi-independent public body, the NJCSCR is "...allocated in, but not of..." the NJDOH. It is subject to all the administrative rules and procedures of NJDOH, but is not a part of the Department and is not included in its budget.

The Commission establishes and oversees the operations of the grants process and other 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 for three-year terms.

Five Commission seats are designated by statute to represent the state's major academic research institutions and stakeholders. Public members provide a diversity of backgrounds and interests united by a shared commitment to the cause of spinal cord research. Any qualified person wishing to be considered for appointment may submit his or her name to the Governor's Office of Appointments. The Commission will always have one or more individuals from each of the following institutions and categories:

- *The Commissioner of the NJDHSS, or designee (voting ex-officio member)*



- *University of Medicine and Dentistry of New Jersey*
- *Rutgers, The State University of New Jersey*
- *Spinal Cord Injury Model System (Kessler Foundation Research Center)*
- *Christopher & Dana Reeve Foundation (American Paralysis Foundation)*
- *Public Members (at least one spinal cord physician and a spinal cord injured individual)*

The NJCSCR holds public meetings at least four times a year. Two-thirds of sitting members constitutes a quorum for all purposes. Members are recused from discussing or voting on matters in which they may have a potential conflict. A Chair and Vice-Chairperson are elected annually and preside over all formal proceedings.

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

ADMINISTRATION

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

The office schedules and facilitates all NJCSCR activities, manages the scientific merit review process, negotiates with outside vendors, and maintains the necessary relationships within state government.

NEW JERSEY SPINAL CORD RESEARCH FUND

The work of the NJCSCR is supported entirely by a statutory one dollar surcharge on all traffic and motor vehicle fines or penalties. Similar sources of funding have been implemented successfully by several other jurisdictions – vehicular accidents are a significant cause of spinal cord injury.

Revenue is collected by the State Treasurer for deposit into the New Jersey Spinal Cord Research Fund. The NJCSCR funds all its grant programs and other activities entirely from this dedicated source. No part of the NJCSCR's operating budget is paid for out of New Jersey's general tax revenue.

MISSION AND GOALS

The New Jersey Commission on Spinal Cord Research implements the commitment of New Jersey to the international quest for cures for catastrophic spinal cord injuries. Through its grants programs and related activities, the NJCSCR reinforces New Jersey's preeminence as a center of biomedical research and a leader in neuroscience, neurotrauma and spinal cord research.



- *The NJCSCR supports meritorious research projects that advance the understanding of spinal cord injury and explore potential therapeutic strategies.*
- *The NJCSCR supports the progression of research from laboratory to animal and clinical applications.*
- *The NJCSCR programs enhance the reputation of New Jersey as a focus of research and increases its attractiveness to researchers and business.*

OBJECTIVES

The NJCSCR seeks to accelerate research that will deepen our understanding of spinal cord injury and open the way to interventions and cures for paralysis and associated conditions. The NJCSCR has identified the following objectives:

- *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.*
- *Promote dissemination of the research findings generated by scientists supported by the NJCSCR.*

RESEARCH FUNDING PRIORITIES



The **NJCSCR Research Guidelines** set forth the Commission's scientific agenda, research criteria and areas of particular interest. They offer applicants detailed guidance and instruction on funding criteria and policies. The full text appears on the NJCSCR website: www.state.nj.us/health/spinalcord.

NJCSCR currently offers an array of grant programs including Individual Research Grants, Fellowships, Exploratory Research Grants, and Spinal Cord Injury Techniques Training Travel Grants. Each of these programs is designed to support and encourage spinal cord research in New Jersey in a unique way. The NJCSCR is continually evaluating its programs and seeking ways to improve its performance and results.



The NJCSCR Research Guidelines

The New Jersey Commission on Spinal Cord Research will fund research activities that hold promise of developing effective interventions and cures for paralysis and other consequences of spinal cord injury and disease. The areas of research listed below highlight the focus of current NJCSCR emphasis and funding:

- *Studying 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.*
- *Evaluating efficacy of drugs and other interventions that prevent or reduce secondary neuronal injury or providing insight into the mechanisms causing progressive damage.*
- *Defining 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.*
- *Elucidating 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.*
- *Developing strategies to prevent or treat secondary complications arising from injury or disease to the spinal cord.*
- *Developing innovative restorative rehabilitation strategies to promote recovery of biological function.*
- *Translating basic and pre-clinical findings into clinical application.*
- *Supporting the investigation of promising new approaches.*

OTHER ACTIVITIES

The NJCSCR is engaged in activities that promote awareness and interest in spinal cord injury and opportunities for research.

The NJCSCR supports the efforts of the New Jersey Department of Health's Center for Health Statistics to establish a "Spinal Cord Injury Registry" - a centralized data base of a standardized data set collected and submitted by each treating hospital on each new case of spinal cord injury in New Jersey.

Such a registry is mandated by statute as a resource for research, evaluation, and information on spinal cord injuries. CHS provides an annual report on spinal cord injury in the state as well as periodic updates to the NJCSCR.



THE NJCSCR APPLICATION AND REVIEW PROCESS

The NJCSCR grants review process was designed to emulate National Institutes of Health standards and procedures to provide an impartial and rigorous review. This effort has been largely successful and has earned respect from grantees and applicants. The NJCSCR application process is now entirely electronic utilizing the New Jersey System for Administering Grants Electronically (NJSAGE) grants management system, and is accessible through the NJCSCR website.

The on-line process ensures broad access, convenience and flexibility, and greatly reduces administrative workloads for applicants, the NJCSCR office, and the Scientific Merit Review Panel.

The NJCSCR administrative staff reviews all applications for completeness and accuracy and assists applicants in correcting errors or omissions.

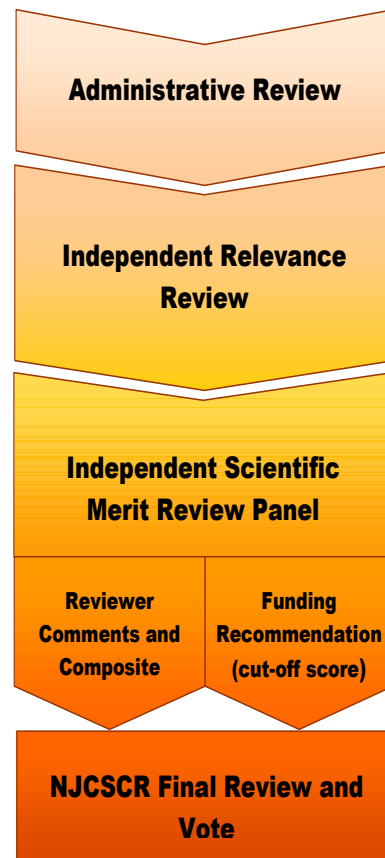
Relevance to the overall goals of the NJCSCR is assessed by an expert panel who also recommend reviewers for each grant from a pool of over 100 highly qualified scientists.

Each application is reviewed and scored independently by two or three peers prior to discussion at the Scientific Merit Review Panel meeting; “triaged” applications are not discussed or scored.

The remaining applications are fully discussed and scored by the entire panel and given a composite score. The panel also suggests a cut-off point for funding. The scores, comments and funding recommendations are delivered to the NJCSCR for final consideration and vote.

The NJCSCR makes the final decision whether to fund each application by majority vote. The Commissioners pay close attention to the results of the Independent Scientific Merit Review, but retain discretion to take other factors into consideration in judging the merit of each application. Any application that was scored and not funded may be resubmitted with appropriate changes in the next grant cycle.

All applicants, regardless of the decision, receive “blinded” reviewer comments. These are often valuable and may help a researcher rethink a project or reframe a future application.





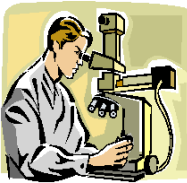
CURRENT GRANT PROGRAMS

NJCSCR grant programs are designed to provide opportunities attractive to a wide range of researchers.

The Individual Research grant is designed to fund senior independent researchers. Fellowship grants offer encouragement to graduate students and post-doctoral researchers. The Exploratory Research grant enables researchers to apply innovative ideas from other areas of science to spinal cord injury and repair in order to acquire preliminary data and successfully apply for larger grants from the NJCSCR, National Institutes of Health, and elsewhere. The Spinal Cord Injury Techniques Training Travel grant offers applicants the ability to participate in a spinal cord injury techniques training course.

Inter-institutional and/or inter-state collaboration is strongly encouraged. Complete details on all NJCSCR programs are available on-line.

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)*
- *Key goal is to enable established researchers to test and develop pilot data needed for future funding.*

Fellowship 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.*
- *Post-doctoral 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)*





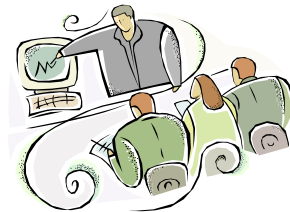
Exploratory Research Grants



- *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.*
- *Up to \$200,000 for a two-year non-renewable grant.*

Spinal Cord Injury Techniques Training Grants

- *Offers applicants the ability to participate in a spinal cord injury techniques training course.*
- *Courses are located at either Rutgers, The State University of New Jersey or at the National Institute for Neurological Disorders and Stroke sponsored Spinal Cord Injury Research Training Program held at the Ohio State University.*
- *A one-time per applicant non-renewable award of up to \$2,999 is provided.*





2001-2012 NJCSCR SUMMARY AND PERFORMANCE RECORD

Since 2001, the New Jersey Commission on Spinal Cord Research has funded 167 separate scientific research projects to scientists at New Jersey academic and research institutions. These awards represent an investment in spinal cord injury research of \$35.9 million.

The NJCSCR receives approximately 40 applications annually, approving 10 or more new awards, totaling between \$2-\$3 million.

As the NJCSCR continues to invest in spinal cord research, the number of New Jersey researchers interested in the field is growing.

Grant Applications

The NJCSCR has received 519 applications from professors, post-doctoral fellows, and graduate students at 14 New Jersey research institutions which cumulatively total \$140.6 million in grant requests.

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

Applications for Individual Research grants typically account for about two-thirds of the total. Interest in both the Fellowship and Individual Research grant programs is historically strong. Fellowships offer the advantage of engaging the greatest number of scientists in spinal cord research for the least cost.

Grant Funding

NJCSCR Individual Research Project 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 NJCSCR is also committed to bringing new researchers and promising students into the field as well. Its programs of graduate and post-doctoral Fellowships have been a success, in both numbers and the quality of applicants.

The Fellowship program is the NJCSCR's most cost-effective initiative, as measured by the number of researchers supported per grant dollar. The Individual Research grants generally support work of greater sophistication and potential importance.

New Jersey Qualified Research Institutions

Under The Spinal Cord Research Act, NJCSCR funds may only go to researchers affiliated with "**New Jersey Qualified Research Institutions**" ("NJQRIs".)



Five institutions are named in the Spinal Cord Research Act and ten others have been designated by the NJCSCR. These organizations provide a continuing source of interest and applications for NJCSCR funds.

Statutory NJQRIs

*Rutgers, The State University of New Jersey
University of Medicine and Dentistry of NJ
Kessler Foundation Research Center
Princeton University
Coriell Institute*

NJCSCR Designated NJQRIs

*New Jersey Institute of Technology
Veteran's Biomedical Research Institute
Stevens Institute
Drew University
JFK Medical Ctr. NJ Neuroscience Institute
Progenitor Cell Therapy, LLC
Seton Hall University
Wyeth Research
TRIM-edicine, Inc.
Rowan University*

Results and Achievements

Cure of spinal cord injury remains an elusive and frustrating goal. Years of intensive research and the investment of millions of dollars by NJCSCR and other organizations still leave much work to be done.

NJCSCR grantees and, to a lesser extent, grantee institutions have capitalized on the opportunities afforded by the availability of Commission funding through advancement of individual careers, increased institutional investment, and applying for additional outside funding. The NJCSCR has been a major factor in fostering this interest and continued involvement in spinal cord research within the State of New Jersey.

The NJCSCR continues to pursue its mission, encouraging and supporting spinal cord research in New Jersey. Many of its researchers can point to significant accomplishments.

- *Numerous scientific articles reporting on work funded by NJCSCR have appeared in peer-reviewed scientific publications, and additional articles are in preparation.*
- *Progress made by NJCSCR researchers has been presented in numerous abstracts, scientific conferences, symposia, and meetings.*
- *NJCSCR programs have enabled wider scientific interaction and research collaborations, many with out-of-state researchers.*
- *Success in achieving NJCSCR funding has resulted in academic and career advancement for New Jersey researchers, including doctoral dissertations.*



- *Over 50 applications to NIH, NSF and other organizations have been submitted, based in part on work funded by NJCSCR grants.*

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



2012 NJCSCR YEAR IN REVIEW

2012 Spinal Cord Research Grants Program

The NJCSCR awarded eight applicants a total of \$2.3 million dollars in 2012. Four Individual Research grants, two Fellowships, and two Spinal Cord Injury Techniques Training Travel grants were funded after a careful review of the 31 applications submitted.

2012 Applications

2012 saw the New Jersey Commission on Spinal Cord Research in its 13th year of operation and its 17th cycle of grants. 31 applications were submitted with requests for funds totaling nearly \$9.3 million.

2012 Outreach and Development Efforts

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

Publication of Grant Programs

Official Notices of Grant Availability advise interested parties of NJCSCR grant programs. These were published in the *New Jersey Register* and in the New Jersey Department of Health *Directory of Grant Programs*.

In 2012, the NJCSCR offered one grant cycle. The NJCSCR has allocated up to six million dollars for spinal cord research projects in 2012, but is not required to award any, or all of that amount.

2012 Grant Cycle

Grant Application Deadline: December 8, 2011

Award Notification Date: June 1, 2012

Available Grant Programs:

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



GRANTS PROGRAM FOR 2013

For Fiscal Year 2013, the NJCSCR has allocated up to six million dollars for spinal cord injury research projects.

The NJCSCR authorized one grant cycle for Fiscal Year 2013 offering Individual Research Grants, Fellowship Grants, Exploratory Research Grants, and Spinal Cord Injury Techniques Training Travel Grants.

2013 Grant Cycle

Grant Application Deadline: December 10, 2012

Award Notification Date: May 31, 2013

Available Grant Programs:

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

*Award Notification Date: February 28, 2013



NEW JERSEY SPINAL CORD INJURY REGISTRY

The Spinal Cord Research Act mandates the establishment and maintenance of a central registry of persons who sustain spinal cord injuries throughout the State. NJCSCR has been supporting the work of the NJDHSS' Center for Health Statistics to create the mechanism for the collection and analysis of spinal cord injury data.

The registry will serve as a resource for research, evaluation, and information on spinal cord injuries. CHS publishes an annual report providing data on spinal cord and brain injuries in New Jersey.

The following tables summarize data collected by CHS on non-fatal hospitalizations for spinal cord injury in New Jersey for the years 2009 – 2011.

2009 - 2011		
<u>GROUPS</u>		
<u>SEX</u>	<u>n</u>	<u>Rate</u>
Males	882	6.8
Females	394	2.5
<u>AGE</u>	<u>n</u>	<u>Rate</u>
Under 15 Years	23	0.5
15-24 Years	151	4.4
25-34 Years	141	4.2
35-44 Years	142	3.8
45-54 Years	194	4.7
55-64 Years	196	6.2
65-74 Years	170	9.2
75-84 Years	156	13.2
85 Years & Older	103	19.0
<u>RACE & ETHNICITY</u>	<u>n</u>	<u>Rate</u>
White Non-Hispanic	785	4.2
Black Non-Hispanic	242	6.9
Hispanic	132	3.3
Asian/Pacific Islander	47	3.0
Other Race/Ethnicity	69	---



2009-2011		
<u>MECHANISM</u>	<u>n</u>	<u>%</u>
Motor Vehicle Occupants	208	14.7
Pedestrian	40	2.8
Pedal Cyclists	20	1.4
Motorcyclists	22	1.6
Unspecified MV Position	11	0.8
Other Transport Vehicles	28	2.0
Falls	647	45.7
Struck By/Against	40	2.8
Assault	77	5.4
Self-Inflicted	14	1.0
All Other Unintentional	117	8.3
All Other Unspecified	183	12.9

Inpatient hospitalizations for spinal cord injuries for New Jersey residents selected according to bill type in the NJ Hospital Discharge Data System. 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. 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.



FINANCIAL STATEMENTS

The activities and programs of the NJCSCR are supported by the New Jersey Spinal Cord Research Fund as established by the Act. A one dollar (\$1.00) surcharge is imposed on all fines or penalties levied under the provisions of Title 39 of the Revised Statutes or any other motor vehicle or traffic violation. The revenue surcharge is collected and forwarded to the State Treasurer and deposited annually in an interest-bearing account designated as the New Jersey Spinal Cord Research Fund.

FUND BALANCE STATEMENT:	SFY 2012 <i>Projected</i>	SFY 2012 <i>Actual</i>	SFY 2013 <i>Projected</i>
Opening Fund Balance (July 1)	\$6,605,081	\$6,788,444	\$8,405,595
Revenues			
Assessments ¹	\$3,600,000	\$3,996,481	\$3,600,000
Investments Earnings - Interest ²	\$24,000	\$15,777	\$15,000
Total Revenue:	\$3,624,000	\$4,012,258	\$3,615,000
Total Funds Available	\$10,229,081	\$10,800,701	\$12,020,595
Disbursements and Expenses			
Disbursements to Grantees	\$6,030,000	\$2,262,079	\$6,030,000
Total Disbursements	\$6,030,000	\$2,262,079	\$6,030,000
Expenses			
Administrative & Office Expense	\$199,078	\$107,335	\$67,400
Professional Review Panel	\$50,000	\$25,693	\$50,000
NJCSCR Registry	\$50,000	\$0	\$0
Total Expenses	\$299,078	\$133,028	\$117,400
Total Disbursements and Expenses	\$6,329,078	\$2,395,107	\$6,147,400
Closing Fund Balance (June 30)	\$3,900,003	\$8,405,595	\$5,873,195
¹ Net revenue variance			
² Funds plus interest deposited annually in Jan.			



2012 RESEARCH GRANT AWARDS

INDIVIDUAL RESEARCH GRANT RECIPIENTS:

Joachim Kohn, Ph.D.

Grant Award: \$593,018

New Jersey Center for Biomaterials

Rutgers, The State University of New Jersey

Project Title: *Improved Implantable Micro-Electrodes for Neural Signal Acquisition*

To enable long-term performance of brain computer interfaces for controlling neural prosthetic devices, this project will develop long-term implantable microelectrodes, or probes. Though once believed to be purely science fiction, bypassing the impaired neuromuscular system to control external devices with thoughts alone is increasingly seen as a viable option for patients who have suffered a spinal cord injury (SCI). Using a device known as a “brain-computer interface” (BCI), signals from the brain are acquired, decoded, and translated into machine commands to perform specific tasks intended by the patient. The signals can be used to (i) bypass the spinal cord and relay information directly to the body, or (ii) to control a device, such as a wheelchair or computer. BCI systems have been shown to re-establish some level of independence and thus, contribute significantly to the quality of life for people with devastating neurologic injuries such as SCI.

While there are other critical components to a functional BCI, the most essential element is getting a strong lasting signal from the brain. Although surface recordings have been somewhat successful, they are not as potentially useful as signals taken from deeper within the brain. Several groups have demonstrated the feasibility of recording nerve signals using implanted microelectrodes, also called probes. Unfortunately there are issues when the current generation probes are implanted in the brain. A process of tissue scarring, called gliosis occurs rendering the probes ineffective within a few months. Various approaches focusing on probe material and design have been investigated to limit the reactions and improve long-term performance. There are two principal theories: (i) larger implanted devices cause damage, and lead to long-lasting gliosis because of a size mismatch compared to cells, and/or (ii) devices made of materials that are less flexible than the surrounding brain tissue induce gliosis. For both, implant size is the key variable, leading to the theory that large, rigid implants are recognized as a foreign body, and small implants are not. Thus, smaller, more flexible devices may reduce gliosis and improve long-term device performance. In this project, we propose to develop small, flexible probes with a strong non-toxic, biodegradable, absorbable polymer coating that will reduce chronic gliosis. Neural recording from probes implanted for the long-term holds great promise for development of rehabilitation strategies following SCI, but the effectiveness of the microelectrodes is limited by gliosis around the probe. We believe that small, flexible probes will reduce or eliminate gliosis. However, they will lack the structural stiffness to be implanted. To solve this problem, we will coat the probes with a rapidly degrading polymer that temporarily increases the probe stiffness to allow insertion, and then degrades to expose the probe. In this project, we will optimize the design of the probe and polymer coating.



Melitta Schachner, Ph.D.

Grant Award: \$357,905

Department of Cell Biology & Neuroscience

Rutgers, The State University of New Jersey

Project Title: *Therapeutic Potential of miRNA 133b in Spinal Cord Injury*

We will investigate functional recovery after spinal cord injury in mouse by application of a microRNA that enhances regeneration in zebrafish and may promote functional recovery in mammals. We have discovered a microRNA (microRNA 133b) that enhances regeneration after spinal cord injury in adult zebrafish, which have the potential, in contrast to mammals, to recover functionally and structurally from complete transection of the spinal cord. This microRNA, which is conserved in sequence across many animal species, including fish, mouse and man, will be tested in the non-regenerating mouse model of spinal cord injury by application of a stable synthetic microRNA and a non-replicative virus (adeno-associated virus which is used in over 50 clinical trials worldwide).

The effects of microRNA 133b on regeneration from spinal cord injury will be tested in acutely injured mice by several criteria for regeneration: walking function, nerve regeneration, sparing of white matter, and suppression of glial scar formation as well as other molecules that inhibit regeneration. We will also test its capacity to modulate the immune response, as treatments that reduce acute inflammation have shown to positively affect functional recovery after injury. In parallel, we will monitor the effects of microRNA 133b application on pain and sensitivity to touch.

These studies are designed to form the basis for validation of the beneficial properties of microRNA 133b in a mammal with very limited capacity for functional and structural recovery from spinal cord injury in adulthood. The aim is to develop microRNA 133b into a reagent that can be applied for therapy in humans.



Martin Grumet, Ph.D.

Grant Award: \$499,207

Department of Cell Biology & Neuroscience
Rutgers, The State University of New Jersey

Project Title: *Molecular & Functional Analysis of Minimally Invasive Lumbar Delivery of Encapsulated MSC for SCI*

Our goal is to analyze the protective effects of mesenchymal stem cells (MSC) in injured spinal cords so that we can maximize the beneficial effects of injecting MSC after injury using a rat model. The use of mesenchymal stem cells (MSC) for clinically relevant treatments of spinal cord injury (SCI) is supported by data indicating that MSC modulate inflammatory reactions, reduces loss of cells, and improves functional outcomes after neural trauma. We have found that both freely migrating and encapsulated MSC in culture and after injection into the injured spinal cord are anti-inflammatory. A main objective of this study is to analyze the beneficial effects of encapsulated MSC on inflammatory cells such as macrophages. We will focus on the encapsulated MSCs because they were more effective in enhancing anti-inflammatory factors and reducing pro-inflammatory factors than freely migrating MSC both in culture and in SCI. moreover, the encapsulation protected MSC survival in the injured spinal cord. Our goals are to analyze MSC effects on specific types of inflammatory cells and factors in culture and during recovery of function in rat SCI.

Toward these goals, we will pursue two aims: 1. To analyze effects of MSC on activated macrophages that are recruited to the spinal cord after injury and on microglia, the resident immune cells of the spinal cord. Studies will first be done in culture with isolated cells to identify changes in specific inflammatory factors, which will then be analyzed in SCI after MSC injection. To measure biochemical effects of encapsulated MSC in rat SCI, MSC will be injected intrathecally into the lumbar enlargement (a procedure similar to the “epidural” commonly used during human delivery) and spinal cord tissue will be tested for changes in inflammatory factors distribution. Changes in the inflammatory factors will serve as criteria in additional experiments to optimize the number and density of MSC in capsules that yield maximal increases in anti-inflammatory and decreases in pro-inflammatory factors. Capsules in the spinal cord will be examined to determine MSC viability over time. 2. To analyze functional effects of encapsulated MSC in SCI, rats will be allowed to survive for 8 weeks while measurements of locomotion and pain will indicate the degree of recovery. After sacrifice at 8 weeks, effects of MSCs on immune and neural cells in the spinal cord surrounding the injury will be analyzed histologically to measure the persistence of inflammation and neuroprotection. Biochemical changes in mRNA and protein expression in and around the injury site will be analyzed in tissue extracts from other rats with similar treatments. The results of these studies will determine whether the optimized MSC capsule yield better outcomes in rat behavior and expression of inflammatory factors after SCI. To determine how further delays in MSC treatment compromises their effects, we will compare 8-week effects of our standard delay of 1 day with delays of 2 and 7 days. The combined results will optimize efficacy of MSC capsules in SCI, provide a window of opportunity for treatment and perhaps biomarkers for the MSC effects that will provide a platform for evaluating this clinically-relevant method of delivering encapsulated cells by lumbar puncture.



Stella Elkabes, Ph.D.

Grant Award: \$598,449

UMDNJ – New Jersey Medical School

Project Title: *Effects of TLR9 Ligands on the Inflammatory Response, Bladder Dysfunction and Chronic Pain in Spinal Cord Injury*

Damage to the spinal cord frequently results from an initial mechanical trauma that causes tissue destruction, cell death and disruption of nerve fibers that connect the brain with the spinal cord. This is followed by changes in the spinal cord including inflammation, which worsens the outcome of the injury. The inflammatory cells produce substances that further harm the remaining cells and nerve fibers, while preventing regeneration. However, not all inflammation is bad. Some inflammatory cells produce substances that enhance tissue repair. Therefore, the balance between the beneficial and detrimental effects of inflammation could impact the outcome of spinal cord injury (sci). Little is known about treatments that alter the inflammatory reaction such that the proportion of cells that produce helpful substances is increased and those that produce harmful substances are decreased. The overall goal of the studies is to evaluate a new treatment that potentially reduces the harmful actions of inflammation while enhancing the protective effects and improves impaired bladder function and chronic pain, two common secondary complications of sci. Inflammatory cells that invade the injured area of the spinal cord express toll-like receptors (TLR) which are best known for activating the immune system in order to protect the host against bacteria. However, TLRs are also present in the central nervous system and have been implicated in the inflammation that follows trauma, albeit their exact contribution is poorly understood. It is believed that damaged cells release mediators that activate TLRs and thereby, modulate the inflammatory response. Preliminary investigations in this laboratory indicated that the delivery of a synthetic TLR9 activator to the spinal fluid amplifies the inflammatory reaction and worsens urinary bladder function in mice sustaining a sci. In contrast, a synthetic blocker of TLR9 attenuates inflammation and improves bladder function. It is well known that inflammation can intensify chronic pain experienced after sci. Based on these findings, it is proposed that a TLR9 activator aggravates the detrimental effects of inflammation and exacerbates bladder dysfunction and chronic pain. In contrast, an antagonist can be used as a therapy to enhance the beneficial properties of inflammation, improve bladder dysfunction and reduce chronic pain.

The studies described in this application use mice with sci. The TLR9 activator and blocker are delivered into the spinal fluid by lumbar puncture and the proportion of different types of inflammatory cells are evaluated at various times following treatment in order to determine the changes observed. In addition, the effects of the treatment on recovery from paralysis, bladder control and hypersensitivity to heat are assessed. The molecular mechanisms underlying some of the effects of the TLR9 activator and blocker are also explored. It is anticipated that the proposed investigations will shed light not only on TLR9 function in sci, but also determine whether the TLR9 blocker can be used to modulate inflammation, improve bladder function and lessen chronic pain. The long-term goal of these studies is to provide a pre-clinical foundation that can support future investigations on the therapeutic potential of the TLR9 blocker in individuals with sci. Some TLR9 activators and blockers have already been approved in clinical trials of other pathological conditions and as such, this could facilitate the design and use of additional activators and blockers to treat complications associated with sci.



FELLOWSHIP GRANT RECIPIENTS:

Ying Li

Grant Award: \$60,000

Department of Biomedical Engineering

Rutgers, The State University of New Jersey

Project Title: *Molecular Mechanism of Notch1 Expression in Spinal Cord Development and Post-SCI Response*

This project is to study the functional role of a Notch1 enhancer and its trans-acting protein factors in spinal cord development in order to provide novel knowledge for spinal cord injury therapy. An unfortunate aspect about spinal cord injury (SCI) is that the damage cannot be reversed, but new treatments are under investigation in labs like my mentor's to find experimental methods that can terminate cell death and promote neural regeneration. The long-term objective of this project is to elucidate the molecular mechanisms that govern gene expression, cell differentiation and axon myelination during spinal cord development, cell death and regeneration after SCI. Understanding of such mechanisms is the basis of cell-based therapies for SCI. The proposed project will focus on the regulation of Notch1 expression. Notch1 is a member of the transmembrane protein family encodes a single-pass transmembrane receptor. It plays a critical role in the development of the central nervous system (CNS) by inhibiting neuronal differentiation, maintaining neural progenitor character, promoting glial differentiation, specifying glial cell type and promoting apoptotic cell death. Notch1 inactivation in the spinal cord results in an accelerated neural differentiation in ventral spinal cord and gradual disappearance of the ventral central canal. Moreover, all subtypes of neural progenitor cells decrease in number, while V0-2 interneurons increase at the expense of some motoneuron subtypes. Although the functional roles of Notch1 in the development of spinal cord have been established, the molecular mechanism that governs the expression of Notch1 is still poorly understood.

Recently, a novel cis-regulatory element of Notch1 (Notch1CR2) that directs gene expression exclusively in the CNS was identified in my mentor's lab using computational and molecular genetics methods. Preliminary study on Notch1CR2 shows its ability to drive reporter gene expression during early embryonic neurogenesis in chick and mouse. Evidences of Its activity in neural stem cells (NSC) suggest its involvement in the regulation of neural cell fate determination. It is highly possible that Notch1CR2 can also regulate NSC re-activation post SCI. Thus here, I propose to investigate the roles of this cis-element and its interacting trans-acting factors in regulating Notch1 expression during normal spinal cord development and after SCI. Full accomplishment of this project will provide possible investigating targets for further spinal cord injury research in both pathological and therapeutic fields.



Nathan Schroeder

Grant Award: \$150,000

Human Genetics Institute

Rutgers, The State University of New Jersey

Project Title: *Stress-Induced Neuroplasticity in C. elegans: A New Paradigm to Study Neuronal Outgrowth Following Spinal Cord Injury*

Stress-induced neuroplasticity in *C. elegans*: A new paradigm to study neuronal outgrowth following spinal cord injury. Spinal cord injuries (SCI) affect over 1 million Americans. Many of the secondary effects resulting from SCI (cardiovascular disease, post-SCI pain, bladder dysfunction) are correlated with the growth or new formation of processes from surviving neurons (i.e. neuroplasticity). Plasticity in surviving neurons is also associated with spontaneous recovery from SCI. While neurobiologists have made great strides in understanding normal development of neuronal processes, it is unclear how plasticity occurs following a traumatic event such as SCI. One factor potentially underlying this plasticity is stress. Researchers have shown that stress-related hormones are increased following SCI and that these same stress-related hormones play an important role in neuroplasticity. A better understanding of how stress affects neuroplasticity may lead to novel treatments for SCI rehabilitation and treatment for SCI-related dysfunctions.

The roundworm *Caenorhabditis elegans* is a well-studied model organism. Similar to mice and fruit flies, *C. elegans* has been used to understand numerous human neurological disorders and to study fundamental questions in neuroscience. *C. elegans* has a simple nervous system, a very short life-cycle allowing for rapid experimentation, a transparent skin allowing for visualization of neurons in live animals, and a completely sequenced genome allowing for comparison to the human genome. I recently discovered that under conditions of stress, a specific class of *C. elegans* neurons undergoes neuroplasticity. For example, specific neuronal processes undergo a 300% increase in length, while other brand new processes are born. Following a return to non-stressful conditions, these processes resorb and return to their previous non-stressed morphology. Given the ease of experimentation in *C. elegans*, we propose using our new discovery to understand the mechanisms of stress-induced neuroplasticity.

In addition to an in-depth characterization of this phenomenon, I have already identified several genes that regulate this stress-induced plasticity. For this fellowship I will continue to identify new genes that affect this stress-induced plasticity. I will also characterize the mechanism by which these genes act. Finally, I will use advanced microscopy techniques to uncover the changes that occur within the neurons during this plasticity. The results of this fellowship may lead to new insights into neuroplasticity following SCI.



SPINAL CORD TECHNIQUES TRAINING GRANT RECIPIENTS:

Cheul H. Cho, Ph.D.

Grant Award: \$2,500

New Jersey Institute of Technology

Stem cell-based therapies for the repair of spinal cord injury have become increasingly popular due to their ability to not only replace lost cell types, but also aid in regeneration. I have over 12 years of research experience in the field of stem cells. I have developed a novel differentiation technique of pluripotent stem cells into endoderm lineage and filed a full patent application in 2010. Ongoing projects in my laboratory include: 1) regulation of oligodendrocyte differentiation from pluripotent stem cells for the repair of spinal cord injury and 2) development of functional 3-D tissue models for tissue repair and regeneration. The Spinal Cord Injury Techniques Training Grant will allow me to apply my stem cell expertise to spinal cord research. This training grant will also provide me with valuable knowledge and hands-on experience in spinal cord research, so that I can conduct innovative and effective research for the repair of spinal cord injury.

Mazell Tetrushvily, M.S.

Grant Award: \$1,000

Princeton University

My goal in enrolling in the spinal cord injury course hosted by Rutgers University W. M. Keck Center for Collaborative Neuroscience is to further my knowledge in spinal cord injury and enhance my research in a manner that would yield promising new advances in the field. My current laboratory research explores the core mechanisms of peripheral synapse loss, a primary deterrent to neuronal regeneration following spinal cord injury, by testing the hypothesis that members of the major histocompatibility complex class I (MHCI) are required for synapse elimination at the developing NMJ. This course, featuring lectures, demonstrations, and hands-on experience in all facets of spinal cord injury research, as well as training in anesthesia, locomotor scoring (BBB), animal care, and outcome measures, will aid in my understanding of spinal cord injury and consequently strengthen my research.