WHERE INCREDIBLE HAPPENS

Spinal Cord Injury Ontario and Toronto Rehab Foundation

Partners in Advancing Spinal Cord Rehabilitation

2019 Impact Report

Toronto Rehab Foundation UHN

Thank You

Since 2001, researchers in the Neural Engineering and Therapeutics Team (SCI research program at the Toronto Rehabilitation Institute – University Health Network) have been working to enhance the recovery of people who experience motor impairment due to neurological trauma or disease. Spinal Cord Injury Ontario has been a vital partner in providing funding and vision for this Team through your support of the fellowship training program; cultivating new talent and expertise in the field of spinal cord rehabilitation. It is with pleasure that we share our 2019 report that demonstrates the incredible impact of Spinal Cord Injury Ontario's investment and key updates at Toronto Rehab and in our spinal cord rehab program.

Spinal Cord Injury Ontario Fellowship

In 2003, Spinal Cord Injury Ontario (then Canadian Paraplegic Association Ontario) established a fellowship program at the Toronto Rehabilitation Institute to support new important areas of investigation with potential to enhance the health and neurorecovery of individuals living with spinal cord injury. The SCIO Fellowship has gone on to cultivate new generations of scientists, professors and researchers who are creating new interventions, therapies and assistive devices while also training new innovators and clinicians in this field.

SCIO's vision and investment is resulting in a massive injection of talent, ideas and inventions that is contributing toward improving lives of individuals with SCI. With your support Toronto Rehab has:

- Attracted talent from across Canada, North America and around the globe to train 14 Spinal Cord Injury Ontario Fellows since 2003; 5 of whom are now University professors in the field of SCI
- Improved care through programs such as: the national SCI-High initiative in advancing best practice in SCI rehabilitation and care, and cardiorespiratory fitness assessment and exercise prescription guidelines for adults with spinal cord injury
- Advanced technologies for SCI treatment such as: developing the ERIGO+FES system for blood pressure regulation and Neuroprosthesis for locomotion
- Made breakthroughs in other areas of SCI research such as: novel image processing techniques for clinical bone research, and pain and pain management

For a full list of SCIO Fellows and a summary of their areas of focus, please see Appendix A.

Dr. Cathy Craven, Toronto Rehab Chair in Spinal Cord Injury Rehabilitation

We are pleased to announce that Dr. Beverley Catherine 'Cathy' Craven is our new head of Spinal Cord Injury Rehabilitation research. In October 2018, Dr. Craven was appointed to the Toronto Rehab Chair in Spinal Cord Injury Rehabilitation at Toronto Rehab. She is a Senior Scientist, Team Leader of the Neural Engineering and Therapeutics (NET) Research Team, supervises the SCI Ontario Fellowship Program, and heads up the Central Patient Recruitment team. Dr. Craven is an Associate Professor in the Division of Physical Medicine and Rehabilitation, Department of Medicine at the University of Toronto. She leads the field with her clinical and research expertise in the prevention and management of sublesional osteoporosis and health services for patients living with multimorbidity after spinal cord injury.

Dr. Craven is also Chair of the Rick Hansen Institute's CARE Committee and founding Chair of the new Canadian Spinal Cord Injury – Rehabilitation Association (CSCI-RA) created to promote access and inclusion

for individuals living with SCI through research, education and advocacy. Craven has been Chair / Co-Chair of the National SCI Conference since its inception in 2004; the 8th conference was held in October 2019.

Dr. Craven's ability to identify and act on new important areas of investigation with potential to enhance the health and neurorecovery of individuals living with spinal cord injury has been a hallmark of her career. To date, Dr. Craven has published over 180 articles and obtained over 15 million dollars in peer reviewed funding. https://www.ncbi.nlm.nih.gov/pubmed?cmd=PureSearch&term=Craven%20BC%20%5Bauthor5D

SCI-High: A National Initiative to Advance Best Practice in SCI Rehabilitation and Care

The SCI-High project, funded by the Ontario Neurotrauma Foundation, Rick Hansen Institute and Toronto Rehab Foundation, was launched in 2016. It is a bold endeavour which aims to select, implement and evaluate indicators of quality rehabilitation care in Canada in the first 18 months after rehabilitation admission by 2020. The SCI-High team was created to develop and implement indicators for 11 domains of rehabilitation care (e.g. heart health, skin integrity, mobility, etc.) for individuals with SCI.

Indicators are measures that can inform how well the health care system is performing in terms of structures and processes of care and provide insight into the associated patient outcomes. Currently, little is known about how well the SCI rehabilitation care system is performing nationally, except for data about rehabilitation length of stay and a basic measure of disability called the Functional Independence Measure. National data describing care (indicator data) are a much needed system barometer to help us ensure equitable and optimal care for persons living with spinal cord injury in Canada.

Rehabilitation Engineering Laboratory – Research Update

Lyndhurst Centre is a best practice centre in spinal cord research and home to the Rehabilitation Engineering Laboratory (REL): a leading research facility devoted to the advancement of knowledge, education and technology in the field of rehabilitation engineering. Since 2001, researchers in the REL have been working to enhance the recovery of people who experience motor impairment due to neurological trauma or disease.

For example, the team has made pioneering advances in delivering functional electrical stimulation (FES) therapy to paralyzed muscles, helping restore movement and function following spinal cord injury or stroke. Using brain-computer interfacing technology, a person's intention to move a limb is identified by analyzing the electroencephalographic (EEG) activity. A complex sequence of electrical pulses is then triggered and applied to different muscles to produce the intended action. The use of electrical stimulation is reduced gradually as the ability to move is restored and it is discontinued completely at the end of this short-term therapeutic intervention.

With a 5,000 sq. ft. facility equipped for technology development, scientific enquiry, and clinical research, the REL supports multiple research groups within TRI's **Neural Engineering and Therapeutics Team**. It is home to a large group of talented, passionate and dedicated individuals from a diverse set of backgrounds who come together to advance scientific knowledge and state of the art technologies in the field of rehabilitation medicine.

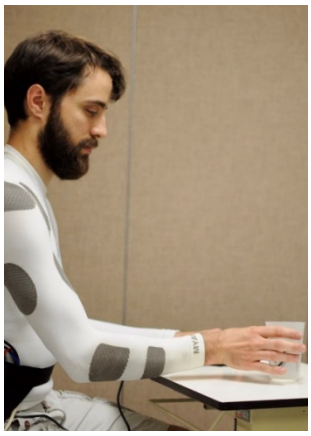
Recent REL initiatives include:

a) Hand function assessment technology

The restoration of upper limb function is usually rated as the top priority by quadriplegic individuals. In order to develop effective new rehabilitation interventions and improve outcomes, it is important to measure and track hand function on a regular basis throughout the rehabilitation process. Because of the enormous complexity of the human hand, creating sensors that can accurately quantify its function is a significant technical challenge. **Dr. José Zariffa**'s team is using tools including computer vision, rehabilitation robotics and bioelectric signal analysis to develop methods that can be used to track hand and upper limb function throughout the rehabilitation process, from the clinic to the home. This information will be used to develop individualized and responsive rehabilitation programs.

b) FES garments

REL researchers led by **Dr. Milos Popovic** are working with Myant Inc. to develop a new generation of stimulation device: FES garments. These shirts and pants, made of conductive and non-conductive fabric, are much easier to set up than existing FES devices, and have the potential to help provide greater access to this beneficial therapy. Researchers are designing and testing the garments with the help of stroke survivors and individuals with spinal cord injury, and continuing to refine these devices to provide state-of-the-art FES control.



c) Spatially distributed sequential stimulation to reduce muscle fatigue

FES can generate muscle contractions for rehabilitation and/or exercise, but traditional methods of application lead to rapid muscle fatigue. **Dr. Kei Masani**'s team has developed a strategy to reduce fatigue, called Spatially-Distributed-Sequential-Stimulation (SDSS), which rotates electrical pulses between multiple active electrodes to mimic natural muscle activation. The overall purpose of this project is to identify a method of delivering FES that maximizes neuromuscular performance, prolonging rehabilitation and/or exercise sessions for the user.

REL research is advancing health innovations to improve care, patient outcomes, and quality of life for individuals with spinal cord injury and their families.

Lyndhurst Centre for Spinal Cord Rehab – Redevelopment Update

Toronto Rehab has embarked on a $10-million renovation to transform Lyndhurst Centre to create a modern, well-designed, and rejuvenated health care facility where both patients and families will feel comfortable, confident and well supported, and where their needs for privacy, confidentiality and personalized care will easily be met. It will also be an effective, efficient working environment where our highly specialized staff will have the space and technology they need to provide exceptional, state-of-the-art health care services.

To enhance the delivery of care, enable increased intake in the number and acuity of patients, and improve rehabilitation recovery and overall patient life outcomes, this much needed renovation includes:

- Improving patient room configurations, lighting and décor while making bedrooms fully accessible;
- Creating more functional spaces for patient and family use;
- Building private, accessible 3-piece bathrooms to replace shared facilities;
- Implementing the latest patient safety including falls prevention and infection control protocols; and
- Essential updates, renovations and retrofits to meet current building codes.

Where Incredible Happens – $100-million Campaign Impact

This past September 2018, Toronto Rehab Foundation celebrated not only the achievement of our $100-million ***Where Incredible Happens*** campaign goal, but also all the hard work and accomplishments that have distinguished Toronto Rehab as a leader in rehabilitative research and care. Together, with partners such as Spinal Cord Injury Ontario, we have so much to be proud of.

Key ways that campaign support is helping make incredible happen include:

- Revitalizing facilities including the Lyndhurst Centre for Spinal Cord Rehab, the E.W. Bickle Centre for Complex Continuing Care, and the Rumsey Cardiac Centre
- Providing sustainable research support through channels such as: fellowships in Technology for Family Caregivers and Prevention; Scholarships for People with Disabilities; and a new Chair in Prevention Research and Health Technologies
- Establishing The Walter and Maria Schroeder Institute for Brain Innovation & Recovery. This $20 million gift represents the largest ever made to a rehabilitation hospital in Canada.
- Injecting targeted support to research studies in areas such as pain, concussion, Multiple Sclerosis, sleep apnea and swallowing
- Expanding virtual outreach through initiatives such as Health e-University that is helping people prevent and manage chronic disease such as heart disease and diabetes
- Better equipping patient programs and establishing new initiatives such as a Transitional Care Centre of Excellence
- Founding education awards to enhance the professional development of clinicians in Toronto Rehab so that they are equipped with the knowledge and expertise to provide the best care possible.

Visionary Leadership and New Five-Year Strategic Plan

2018-19 also saw new changes to leadership at University Health Network and a new vision for its future.

UHN's new 2019-23 Strategic Plan was recently released and represents months of collaboration with patients, families, partners and Team UHN – staff, physicians, researchers, learners and volunteers. With the plan comes UHN's new vision, **A Healthier World**, and five Strategic Priorities to help us deliver on that promise through care, research and education:

1. Inspire, invent and deliver tomorrow's care
2. Empower and invest in a diverse Team UHN
3. Drive the convergence of care, research and education
4. Unleash the power of technology and innovation
5. Elevate Canada as a world destination for commercialization and discovery

Toronto Rehab has added new members to its Executive to help lead this vision, including:

Dr. Kevin Smith, President & Chief Executive Officer of UHN officially started his role officially on May 22, 2018. He joined UHN from St. Joseph's Health System and Niagara Health System, where he spent 23 years in various leadership roles including CEO. Dr. Smith is passionately committed to the mission of education, research and exemplary clinical care and is a pioneer in advancing integrated care models.

Dr. Milos Popovic was appointed to the position of Director of Research at Toronto Rehabilitation Institute. Dr. Popovic has been with Toronto Rehab throughout his career and has an incredible list of scientific accomplishments that includes leadership of the new CenteR for Advancing Neuro-technological Innovation to Application (CRANIA) project, which will bring transformational new infrastructure to support research in neuromodulation therapy.

Dr. Mark Bayley, Program Medical Director for Toronto Rehab and Physiatrist-in-Chief for UHN was recently appointed to this senior executive position having played a critical role in building Toronto Rehab's unparalleled Brain and Spinal Cord Rehab Program as Medical Director. A clinician scientist, Dr. Bayley was first recruited to establish Toronto Rehab's Neuro Rehab program in 1999. He is passionate about integrating research into day-to-day practice by launching clinics such as Toronto Rehab's Hull-Ellis Concussion and Research Clinic, The Rocket Family Upper Extremity Clinic, and LIFEspan.

Incredible Work Ahead

Every day, Toronto Rehab is committed to ensuring the best outcomes for patients facing the most challenging times in their lives, providing individuals affected by traumatic injury with the strategies needed to recover lost abilities, increase strength and return to their lives.

With our donors as partners, Toronto Rehab is on a trajectory toward significantly impacting global rehabilitation and enhancing quality of life for those living with chronic and complex health issues. By innovating in modern areas of health crisis such as preventative medicine, dementia, pain management, concussion, falls prevention, sleep apnea and restorative technology, Toronto Rehab is leading the way to better, healthier, more active living.

We are grateful to Spinal Cord Injury Ontario for your important partnership with Toronto Rehab.

Thank you for helping ***make incredible happen***.

Appendix A: Supervised Spinal Cord Injury Ontario Fellows

Fellowships are the most common form of masters and post-graduate training for clinical scientists and researchers, allowing the Fellow to:

- Be mentored by a senior scientist
- Publish material from thesis research
- Participate in ongoing research at Toronto Rehab
- Learn how to work in the research milieu with graduate students
- Write research proposals and develop a career line of research

The following lists those who have received SCIO Fellowship funding at Toronto Rehabilitation Institute since the program was established in 2003:

Jun 2018 – Feb 2020	**Dr. Christopher Rowan - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Program title: Virtual Integration Platform for Spinal Cord Injury (VIP4SCI) *Recipient of:* Spinal Cord Injury Ontario Postdoctoral Fellowship, Toronto, Canada, June 2018 ($108,227 plus benefits over 2.5 years)
May 2017 – Nov 2019	**Dr. Matheus Wiest - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Program title: 1) Spinal Cord Injury (SCI) Rehabilitation Care - High Performance Indicators (SCI-High) 2) Development of the spinal cord injury Rehabilitation Translational Continuum Team (ReCon Team) *Recipient of:* Spinal Cord Injury Ontario Postdoctoral Fellowship, Toronto, Canada, May 2017 ($125,000 plus benefits over 2.5 years)
Jan 2016 – Dec 2017	**Dr. Bastien Moineau - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Program title: ERIGO+FES system for blood pressure regulation in SCI individuals. *Recipient of:* Spinal Cord Injury Ontario Postdoctoral Fellowship, Toronto, Canada, January 2016 ($100,000 over two years)
Nov 2015 – Nov 2016	**Dr. Tomas Cervinka- *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Program title: Novel image processing techniques for clinical bone research. *Recipient of:* Spinal Cord Injury Ontario Postdoctoral Fellowship, Toronto, Canada, November 2015 ($50,000 over one year)
Oct 2014	**Dr. Austin J. Bergquist - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Program title: Investigation of the electrophysiology of muscle contractions produced by MyndMove electric stimulator Current position: Director of Program Services at Oobliq *Recipient of:* • Canadian Institute of Health Research Postdoctoral Fellowship, Ottawa, Canada, October 2015 ($100,000 over two years)

	• Spinal Cord Injury Ontario Postdoctoral Fellowship, Toronto, Canada, October 2014 ($50,000 over one year)
Jan 2012 – Nov 2012 Leave of absence Jan 2013 – Nov 2013 Dec 2013 – Nov 2014	**Dr. Cheryl Lynch - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute and University of Waterloo Program title: Limitation of CAROC and FRAX for predicting fracture after SCI Current position: Trainee *Recipient of:* Spinal Cord Injury Ontario Postdoctoral Fellowship, Toronto, Canada, Jan 2012 to Aug 2012 ($50,000 pro-rated split 50% each between CPA & Research Core); Sept 2012 to Nov 2012 ($7,692) and Dec 2013-Nov 2014 ($50,000 over one year)
Sep 2013	**Dr. Chelsea Pelletier - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Supervisor: Dr. B.C. Craven, Neural Engineering and Therapeutics Team, Toronto Rehabilitation Institute, University Health Network Program Title: Cardiorespiratory fitness assessment and exercise prescription guidelines for adults with spinal cord injury Current position: Professor at the Simon Fraser University, B.C., Canada *Recipient of:* Spinal Cord Injury Ontario Postdoctoral Fellowship, Toronto, Canada, September 2013 ($50,000 over one year)
Jul 2013 – Jun 2014	**Dr. Hossein Rouhani - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Supervisor: Dr. Milos Popovic, Neural Engineering and Therapeutics Team, Toronto Program Title: Neuroprosthesis for sitting Current position: Assistant Professor, Engineering, University of Alberta *Recipient of:* • Spinal Cord Injury Ontario Postdoctoral Fellowship, Toronto, Canada, June 2013 ($50,000 over one year) • Swiss National Science Foundation, Bern, Switzerland, July 2014 ($50,000 over one year); January 2012 ($60,000 over two years)
Nov 2011 – Mar 2013	**Dr. Jose Zariffa - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Supervisor: Dr. Milos Popovic, Neural Engineering and Therapeutics Team, Toronto Program Title: Bioelectric source localization in peripheral nerves and advanced FES applications Current position: Scientist at Toronto Rehab and Professor at the University of Toronto, Canada *Recipient of:* Spinal Cord Injury Ontario Postdoctoral Fellowship, Toronto, Canada, Nov 2011 ($50,000 over 1.25 years)
Oct 2009 – Sep 2012	**Dr. Santa Concepción Huerta Olivares - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Co-supervisor: Dr. A. Prodic, Department of Electrical and Computer Engineering, University of Toronto Program title: Implantable electric stimulator Current position: Design Engineer at Exar, Canada *Recipient of:* Canadian Paraplegic Association Ontario Postdoctoral Fellowship, Toronto, Canada, September 2009 ($150,000 over three years)
Oct 2008 – Apr 2009	**Dr. Dimitry Sayenko - *SCIO Postdoctoral Fellow***

May 2009 – Apr 2011	Institution: Toronto Rehabilitation Institute and Fraser Institute, University of Louisville Co-supervisor: Dr. K. Masani, Toronto Rehabilitation Institute Program Title: Neurophysiology of Standing, Changes in H-Reflex with Whole Body Vibration *Recipient of:* Spinal Cord Injury Ontario Postdoctoral Fellowship, Toronto, Canada, Oct 2008 to Apr 2009 and May 2009 to Apr 2011 ($122,500 over 2.5 years)
Dec 2005 – Nov 2008	**Dr. Judith P. Hunter - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Co-supervisor: Prof. K. Boschen, Graduate Department of Rehabilitation Sciences Program title: Pain and pain management in SCI population Current position: Professor at the University of Toronto, Canada *Recipient of:* • Interfaculty Pain Curriculum at University of Toronto received the Northrop Frye Award, May 2007 (Dr. Hunter was one of the organizers of the Interfaculty Pain Curriculum at the University of Toronto) • Canadian Paraplegic Association Ontario Postdoctoral Fellowship, Toronto, Canada, October 2005 ($150,000 over three years)
Oct 2005 – Apr 2014	**Dr. Masae Miyatani - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Co-supervisor: Dr. C. Craven, Toronto Rehabilitation Institute Program title: Effects of diverse interventions on improvement of the physical fitness level and the reduction of the risk factors of lifestyle-related disease in SCI population Current position: Clinical Research Coordinator, Neural Engineering and Therapeutics Team, Toronto Rehab *Recipient of:* • The Craig H. Neilsen Foundation Postdoctoral Fellowship, Encino, USA, April 2011 ($135,000 over two years) • Ontario Neurotrauma Foundation Post-doctoral Fellowship in Spinal Cord Injury Research, Ontario, Canada, August 2009 ($90,000 over two years) • Canadian Paraplegic Association Ontario Postdoctoral Fellowship, Toronto, Canada, October 2005 ($120,000 over three years)
Mar 2003	**Dr. T. Adam Thrasher - *SCIO Postdoctoral Fellow*** Institution: Toronto Rehabilitation Institute Program title: Neuroprosthesis for locomotion Current position: Professor at the University of Houston, USA *Recipient of:* Canadian Paraplegic Association Ontario Postdoctoral Fellowship, Toronto, Canada, March 2003 ($210,000 over three years)