GRADUATE PROGRAM IN NEUROSCIENCE

MARION MURRAY SPINAL CORD RESEARCH CENTER

DREXEL UNIVERSITY
Graduate School of
Biomedical Sciences and Professional Studies
College of Medicine

OUR MISSION

Advance the field of spinal cord injury, from the fundamental understanding of motor and sensory networks to innovation in therapeutic strategies.

ABOUT US

The Marion Murray Spinal Cord Research Center is engaged in innovative and multidisciplinary research focused on spinal cord injury using state-of-the-art approaches to identify neural pathways involved in functional impairment and define the best therapeutic strategies to foster recovery including regeneration, cell transplantation, drug therapy, rehabilitation, spinal cord and cortical stimulation and robotics. These approaches represent the most sophisticated techniques of contemporary neurobiology, computational neuroscience and neuroengineering.

OUR RESEARCH

Laboratories in the Marion Murray Spinal Cord Research Center use an array of techniques to investigate the processes and mechanisms by which the spinal cord is affected by traumatic injury, and the resulting functional deficits:

- Autonomic dysreflexia (Hou, Tom)
- Bladder function (Hou)
- Breathing (Bezdudnaya, Lane, Rybak)
- Cardiovascular function (Hou)
- Pain and inflammation (Detloff)
- Sensory loss (Fischer)
- Spasticity and hyperreflexia (Côté, Dougherty, Giszter)
- Locomotion (Ausborn, Côté, Danner, Dougherty, Giszter, Rybak)

We develop advanced strategies for activating and modulating the coractivity of neuronal networks.

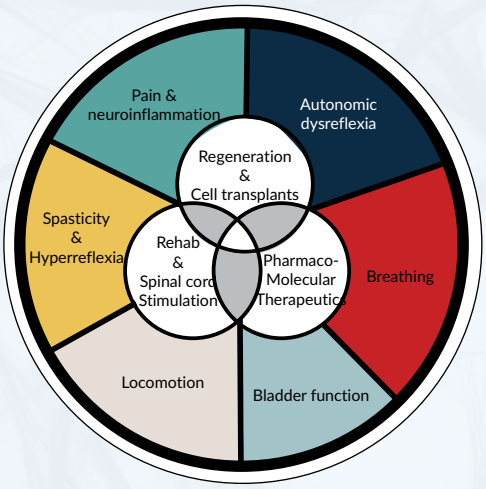
OUR FACILITIES

State-of-the-art facilities at the Marion Murray Spinal Cord Research Center include:

- Confocal microscopy core
- Immunohistochemistry core
- Laser microdissection
- Locomotor function testing (CatWalk, open field, 3D kinematics and force analyses)
- Optogenetics
- Optical imaging and multielectrode recordings
- Patch clamp
- Rehabilitation (treadmill, running wheels, bikes, strength training, reaching, robotics)
- Sensory function testing (Von Frey, Hargreaves)
- Surgery suite
- Telemetry

COLLABORATIVE ENVIRONMENT

We develop advanced strategies for targeting and modulating the activity of neuronal networks. Axons fail to regenerate following injury, leading them to be permanently disconnected from their target neurons. This results in persistent loss of motor and/or sensory function. Our collaborative environment encourages a combination of therapies to enhance functional recovery with the latest in rehabilitation, regenerative drug therapies, genetic manipulations and cell transplantation strategies for repair of multiple sensorimotor functions.



Our work focuses on:

Regeneration and cell transplants

Promoting regrowth of injured axons across a lesion site to reestablish connections and, hopefully, mediate functional recovery. Among the various cellular and molecular strategies we are using to promote regeneration, stem cells transplanted at the injury site are promising to induce structural and functional repair of the spinal cord or descending controls (Fischer, Hou, Houle, Lane, Tom, Giszter).

Rehabilitation and spinal cord stimulation

Promoting activation of spinal networks is critical to foster functional recovery after SCI. Our group focuses on various rehabilitation strategies as well as epidural and transcutaneous spinal cord stimulation (Côté, Detloff, Dougherty, Giszter).

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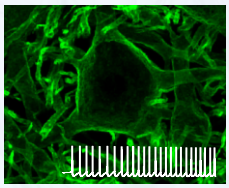
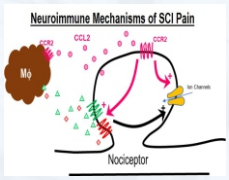
FACULTY HIGHLIGHTS

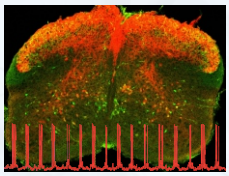
The Côté Lab investigates how activity-based therapies and rehabilitation programs improve reflex modulation and locomotor recovery after SCI. We further study the potential for epidural and transcutaneous spinal cord stimulation to improve sensorimotor activity.



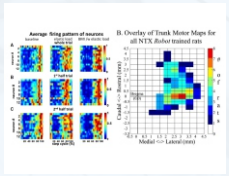
The Detloff Lab focuses on how injury and exercise modulate neuroimmune mechanisms contributing to pain development after spinal cord injury.



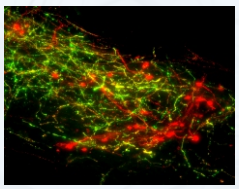
The Dougherty Lab studies spinal neuronal circuits that control locomotion, focusing on locomotor rhythm generating mechanisms and plasticity of spinal circuits following SCI and therapeutic strategies aimed at improving locomotion.



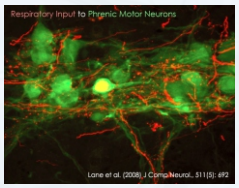
The Giszter Lab tests cortical and spinal mechanisms in SCI recovery focusing on modularity. Tests include robot rehab; intraspinal, intracortical and epidural stimulation; optogenetics;optical imaging; viral therapies and bridging.



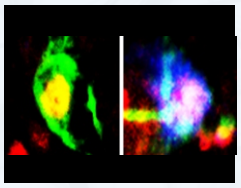
The Hou Lab works on elucidating mechanisms underlying autonomic dysfunction following SCI, and exploring pharmacological and cellular therapeutic strategies for cardiovascular and micturition functional recovery.



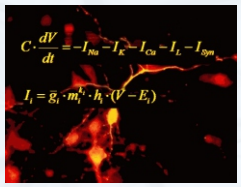
The Lane Lab focuses on developing rehabilitative and cellular therapies to promote neuroplasticity and repair the injured cervical spinal cord.



The Tom Lab investigates axon plasticity (i.e., how to promote beneficial plasticity or limit maladaptive plasticity) to promote functional recovery after spinal cord injury.



The Ausborn, Danner and Rybak Labs (all Computational and Theoretical Neuroscience) focus on theoretical and computational modeling of neural circuits in the brainstem and spinal cord involved in neural control of locomotion and breathing.



STUDENT SUCCESS AND MENTORSHIP

Mentorship and Support:
Faculty from the MMSCRC are supported by grants from the NIH, NSF, Department of Defense, Craig H. Neilsen Foundation and Wings for Life.

NIH NINDS T32 Training Grant Support and Mentoring:
A recently awarded T32 training grant provides focused support and, more importantly, broad training opportunities for all students in SCI research. Training focuses on technical skill development, mentorship, networking and deep quantitative literacy needed for interdisciplinary success. Seminar series, workshops and retreats are supported.

Conferences & Networking Opportunities:
Our students attend national and international conferences to network with leaders in neuroscience research. Conferences include Society for Neuroscience, National Neurotrauma Symposium, International Symposium on Neural Regeneration, International Spinal Research Trust Symposium, Gordon Research Conference on Spinal Cord Injury and Repair: From Molecules to Function, and American Spinal Injury Association.

Student Success:
Recent PhD graduates are postdoctoral fellows at University of California San Francisco, Columbia University, University of Pennsylvania, and University of British Columbia. Others serve as a program analyst at NIH and as a computer analyst in the FBI. Three MD/PhD students completed the PhD requirements in the last three years.

Get in Touch

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