icord

ANNUAL REPORT

2020-21

THE UNIVERSITY OF BRITISH COLUMBIA

ICORD ANNUAL REPORT 2020-21

INSIDE:

ICORD AT A GLANCE:

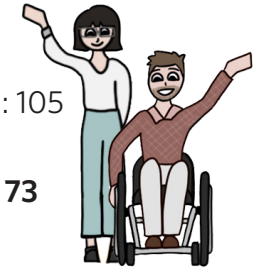
People

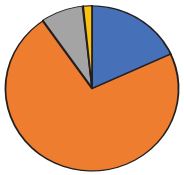
Researchers: 82
- PIs: 48
- Investigators: 17
- Associate Members: 14
- Emeriti: 3

Trainees: 283
- Undergrads: 99
- Masters: 73
- PhD: 77
- Postdocs: 29
- Residents: 5

Staff: 113
- Technical: 105
- Admin: 8

Volunteers: 73





Funding

Competitively-funded research grants held by PIs: $15,460,150(including $12,360,040 for SCI-related projects)

Blusson Integrated Cures Partnership: $1,350,893

UBC: $300,000

Publications

Total publications: 383
(including 253 peer-reviewed journal articles, and 48 papers with multiple-ICORD authors)

ICORD ANNUAL REPORT 2020-21

INTRODUCTION

I am happy to present this annual report, covering ICORD's accomplishments from April 1, 2020, to March 31, 2021.

In the introduction to last year's annual report, I wrote that I looked forward to the day when we could "all be working to make spinal cord injury preventable, livable, and curable together again." At the time, I thought that day would have come by now. Although many of us have returned to working on-site, we are far from back to normal. In fact, this report covers an entire year of doing research during the global COVID-19 pandemic.

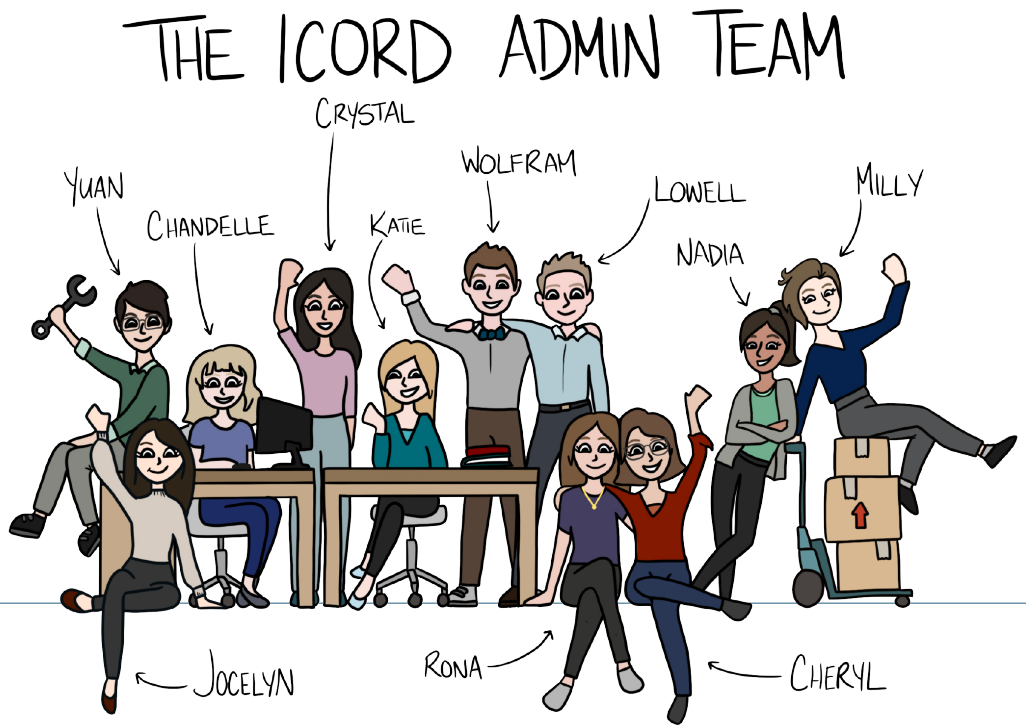
From mid-March to July of 2020, only the most urgent on-site work was allowed. Throughout the summer and fall of 2020, some lab work resumed under strict COVID safety plans. Meetings and events, including our Annual Research Meeting, took place over Zoom. Even working apart, though, we were still able to celebrate some successes, including prestigious awards to faculty members and significant research grants. New researchers joined us, we worked on innovative projects, and published exciting papers.

Because we weren't able to get together for photos this year, we hired talented Lam Lab student Maya Sato-Klemm to create cartoon drawings of our groups, which you will find throughout this report. I think they really capture our collaborative spirit!

My colleagues and I are incredibly grateful for the continued support of the Rick Hansen Foundation, especially during such a difficult year. Most—if not all—of our collective achievements were made possible, either directly or indirectly, through the investments that the Foundation has made in us.

Together we made it through a challenging year, and I am feeling optimistic for the future. I hope you enjoy reading this report, and look forward to being able to report on a more normal year next summer (fingers crossed!).

WOLFRAM TETZLAFF, MD, PHD
DIRECTOR OF ICORD
PROFESSOR, ZOOLOGY & SURGERY, UBC



In addition to the core administrative staff (Yuan Jiang, Chandelle Coleman, Katie Ashwell, Lowell McPhail, Cheryl Niamath, and Nadia Ighani), this drawing also includes current and former UBC Work Learn student assistants (Jocelyn Chan, Crystal Han, and Rona Herzog), and PARC manager Milly Zaletelj. This Admin "Quaranteam" supported each other during the pandemic through daily friendly emails and weekly meetings on Zoom.

HIGHLIGHTS FROM 2020-21:

Dr. Dena Shahriari joined ICORD from M.I.T.

Dena Shahriari

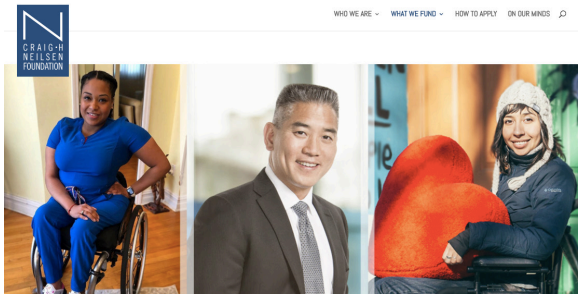
In January 2021, materials scientist and neural engineer **Dr. Dena Shahriari** joined ICORD as a new assistant professor in the UBC departments of Orthopaedics and Biomedical Engineering. With the support of the Rick Hansen Foundation, she is currently setting up the BioAugmentative Interfaces Lab at ICORD and has hired a keen PhD student. Dr. Shahriari is passionate about spinal cord repair and improving function after nerve injuries. She also strives to introduce technologies that can be readily accessible to other researchers and clinicians to join forces in expanding science and improving human health.

Researchers collaborated on significant DARPA grant

An international research team, co-led by **Drs. Brian Kwon, Chris West and Babak Shadgan** received a US$36.5M grant (of which US$9M will come to ICORD) for research that aims to revolutionize SCI treatments using innovative, implantable technologies. The five-year project—made possible through a grant from the United States Defense Advanced Research Project Agency (DARPA)—is based on a 2015 ICORD seed grant. The research team will tackle the entire continuum of care, from stabilization of acute injury using revolutionary biologic and engineering techniques to addressing the challenges of chronic paralysis by regenerating lost connections between the patient's brain and spinal cord through the delivery of neural stem cells to the injury site through a 3D-printed biodegradable scaffold. With the aim of restoring lost function in people living with SCI, the researchers will also use implantable technologies to electrically stimulate the spinal cord and record signals from the brain to drive voluntary movements.

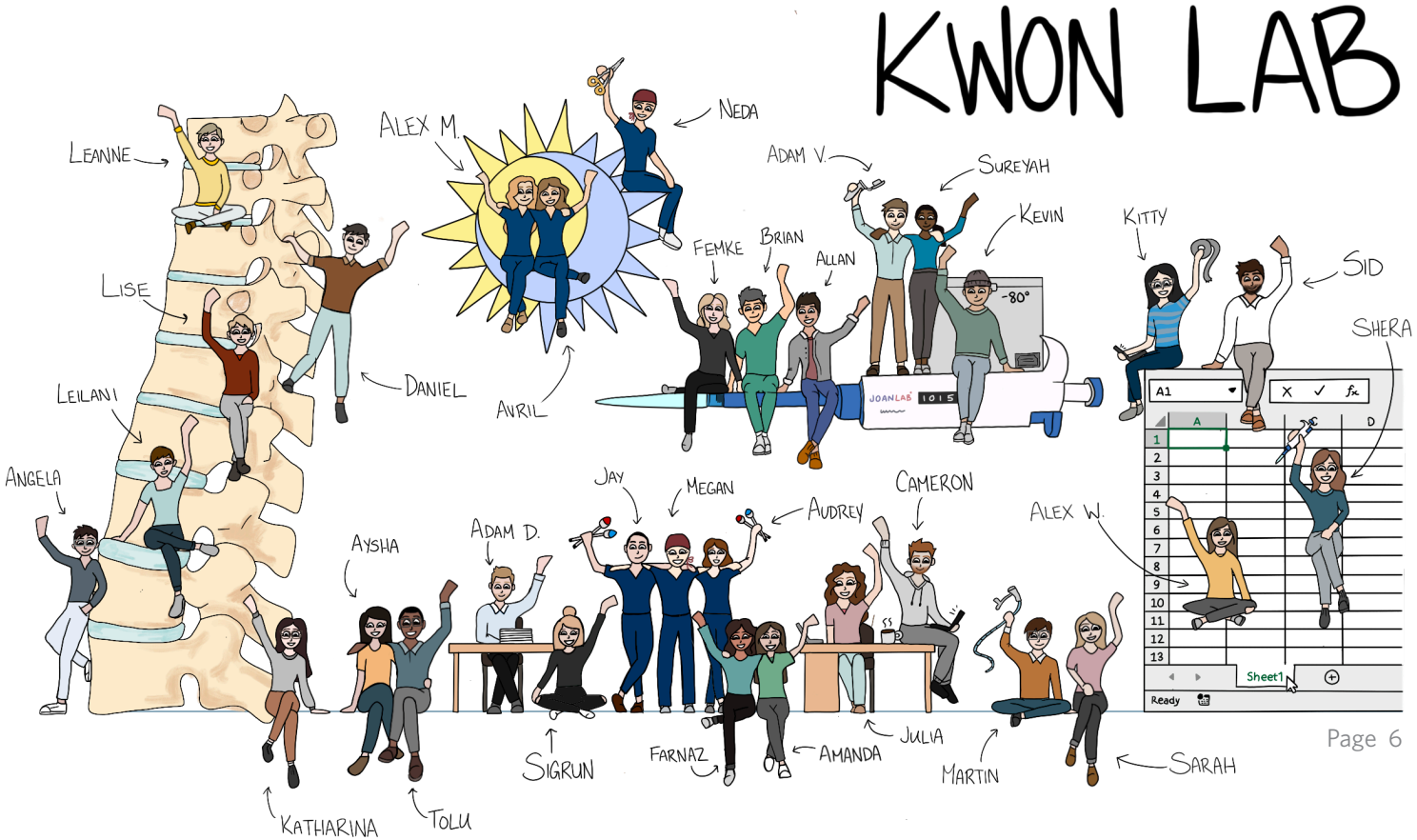
The UBC team will lead the project's acute injury stabilization efforts, developing fully implantable technologies to monitor the status of the injured spinal cord. This information will then be fed into an electrical stimulation system that will control a patient's blood pressure to optimize delivery of blood and oxygen to the damaged spinal cord tissue. Their aim is to see this technology implanted into an acutely injured patient with SCI at Vancouver General Hospital by the final year of the DARPA grant.

Dr. Brian Kwon received major honour



L-R: Andrea Dalzell , Brian Kwon, Reveca Torres

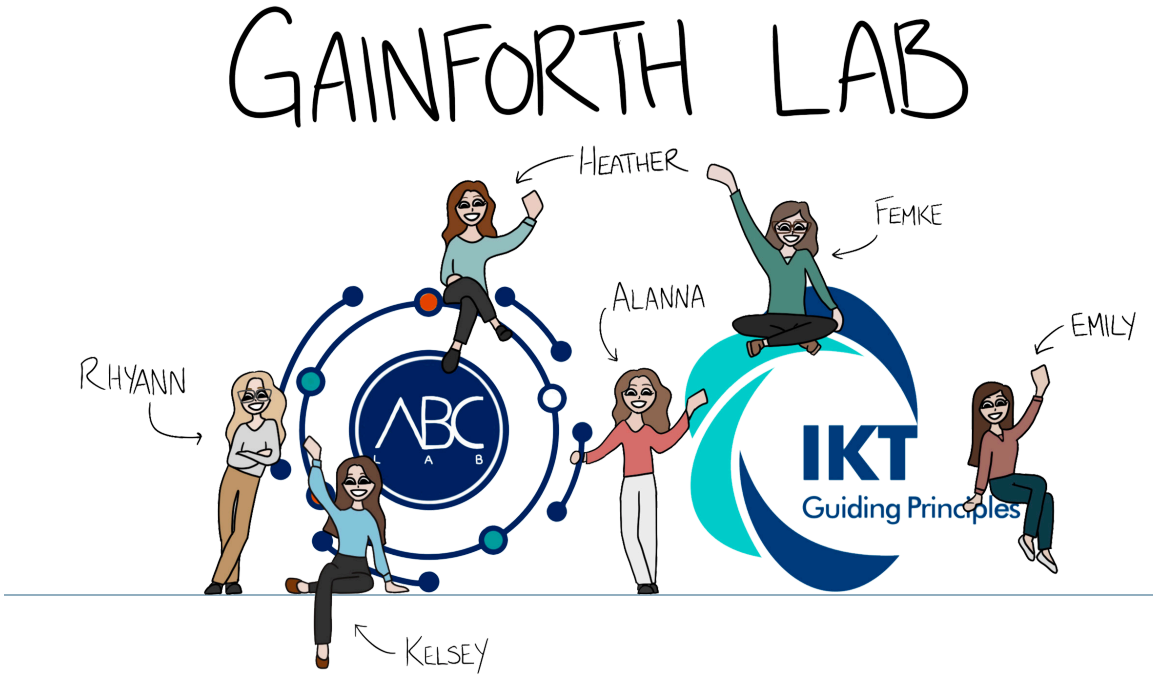
Dr. Brian Kwon is one of three winners of the inaugural Craig H. Neilsen Visionary Prize. Dr. Kwon and co-winners Andrea Dalzell and Reveca Torres, each received US$1 million for their distinctive contributions and demonstrated excellence in the world of spinal cord injury. The Visionary Prize honours the memory and legacy of Craig H. Neilsen, an American entrepreneur who was severely injured in a car accident in 1985, leaving him with quadriplegia, with only minimal function of his left hand. Craig's tenacity and extraordinary focus fuelled his success in business after his accident. The prize recipients reflect many of the qualities for which Craig was well known, including his remarkable determination, inexhaustible passion, and an ability to inspire those around them.



Integrated knowledge translation Guiding Principles developed

Integrated knowledge translation (IKT): meaningful engagement of the **right research users** at the **right time** throughout the SCI research process.

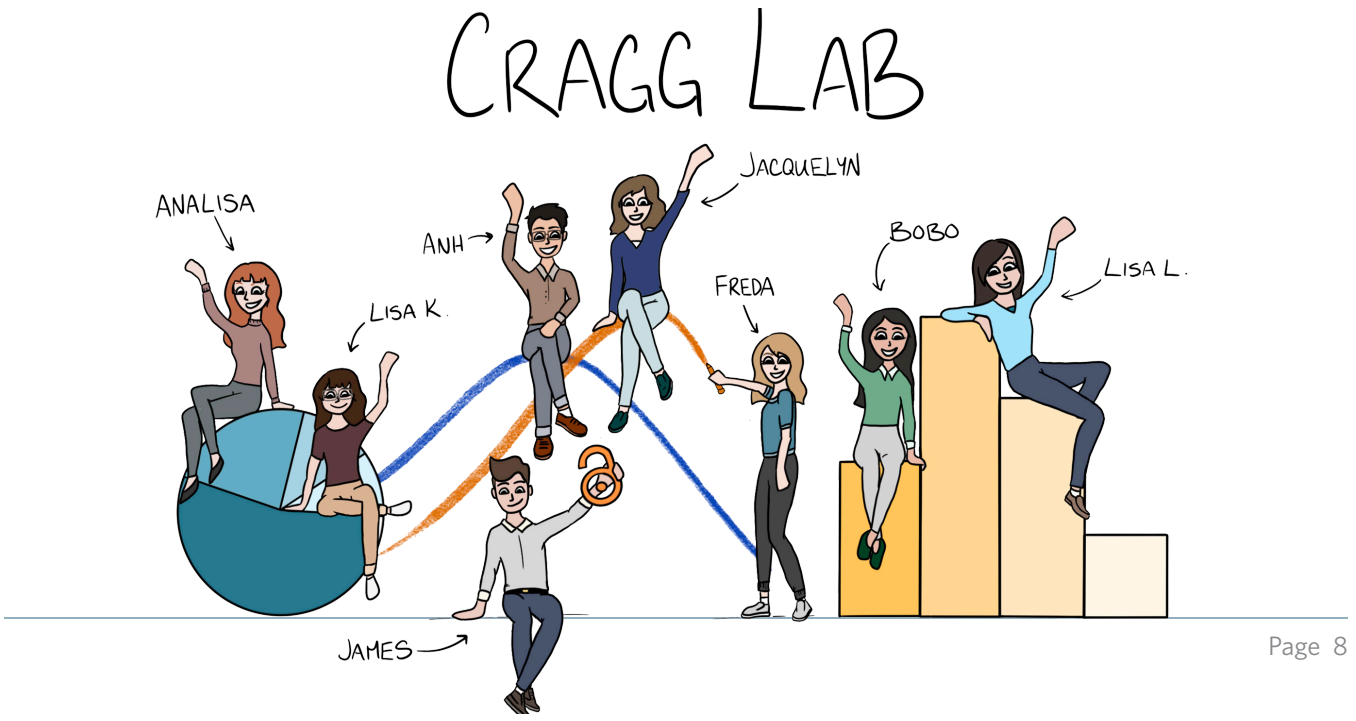
Research that could enhance the lives of people with SCI is often not applied in practice. To close this gap, funders, researchers, and research users have emphasized the importance of using research partnerships between researchers and research users. To help SCI researchers and research users engage more meaningfully in research that is relevant, useful, and/or useable, a multidisciplinary group of SCI researchers, clinicians, people with SCI, representatives from SCI community organizations, and funding agencies, led by **Dr. Heather Gainforth,** developed integrated knowledge translation (IKT) guiding principles. The principles were recently published in Archives of Physical Medicine and Rehabilitation. The eight principles represent the first rigorously co-developed, consensus-based guidance to support meaningful SCI partnerships. The principles are meant to be used early and throughout the entire research process. By applying the principles, researchers have the potential to combat tokenism and improve the relevance and impact of SCI research. To date, the IKT Guiding Principles have been accessed by users in 22 different countries and were recently cited in *The Lancet* as a powerful approach for ensuring research findings are relevant, useful, and used.



Jacquelyn Cragg

Dr. Jacquelyn Cragg awarded CRC

Dr. Jacquelyn Cragg was awarded a Canadian Institutes of Health Research Tier 2 Canada Research Chair (CRC) in Open Data Science in the Fall 2020 funding competition. Dr. Cragg's current research aims to identify causes, risk factors, and biomarkers of neurological disease progression, including Parkinson's disease, amyotrophic lateral sclerosis, multiple sclerosis, SCI, and stroke. Her research uses advanced analytical techniques and has applications in modelling disease progression, drug safety, and drug repurposing.



New helmet designed

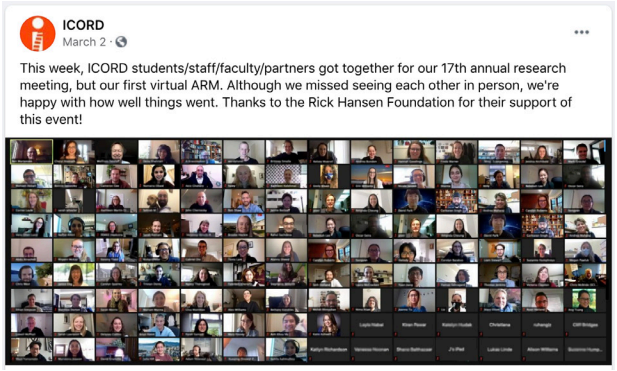
Dr. Peter Cripton and his team have designed a next-generation helmet that can reduce the risk of SCI, and are working with UBC's Industry Liaison Office to file patent applications and finalize product design before launching in the downhill mountain biking community by the middle of next year. The helmet, named **Pivot**, works by reducing forces on the neck in high-risk impact by more than 40%. In a head-on impact, Pivot guides the head into a small amount of flexion, significantly reducing the dangerous compressive loads on the neck. Pivot builds on previous research done by Dr. Cripton and his colleagues in the **Orthopaedic and Injury Biomechanics Group,** which resulted in two patents and has been published in a peer-reviewed journal. The new Pivot technology requires much less hardware, is simpler to manufacturer and has shown higher reductions in neck loads.

Adapted rowing ergometer developed

A project initiated with ICORD seed funding for Drs. Carolyn Sparrey, Bonnie Sawatzky, and Jaimie Borisoff in 2018 has developed into a robust collaboration with visiting professor Dr. James Laskin of the University of Montana. The group was able to characterize the energetics of the adapted rowing erg (AROW) . They also explored the user response to the system and feedback for design revision with Dr. Ben Mortensen. This work provided the foundation for a $100,000 USD Craig H Neilsen Foundation Grant awarded in September 2020.

Research meetings moved online

On March 1 and 2, 2021, ICORD's **Annual Research Meeting** took place over Zoom. More than 170 ICORD faculty, staff, and students, and members of partner organizations logged in to hear fourteen talks about new SCI research coming from ICORD labs, including Dr. Janice Eng (COVID-19 and SCI), Dr. Tania Lam (exoskeleton training may improve urinary continence in people with SCI), Dr. Mohsen Akbari (development of a novel wound dressing that can indicate the presence of infection), and Dr. Andrei Krassioukov (neuromodulation and epidural stimulation for SCI). The Rick Hansen Plenary Lecture for 2021 was given by Dr. Alyson Fournier of McGill University, whose talk was titled "Regulating neuronal signaling to promote axon regeneration." This was a very interesting and comprehensive talk about understanding the molecular mechanisms that prevent nerve fibre growth after SCI, including novel strategies how we might overcome this. During the two-morning event, 48 trainees and staff members presented posters describing their research projects. The face-to-face interaction we normally have during these sessions was definitely missing, but the Zoom presentations were still exciting. ICORD's Annual Research Meeting brings together SCI researchers and community partners to share our work, forge new collaborations, and celebrate one another's accomplishments.



ICORD Trainee Committee hosted their **Trainee Symposium** on November 18 and 19, 2020. This annual event is planned, organized, and executed by trainees, offering the organizing committee excellent networking experience. In 2020, the students also learned how to organize a virtual conference, and welcomed 108 participants. The symposium was a very interesting

event with eight research talks and 32 poster presentations. Plenary talks were presented by Drs. Fadel Zeidan (UC San Diego), Tor Wager (Dartmouth College), Philip Popovich (Ohio State University), and Franziska Denk (King's College London). ICORD is sincerely grateful to the **Rick Hansen Foundation** for its ongoing and generous support of both the Annual Research Meeting and the Trainee Symposium.

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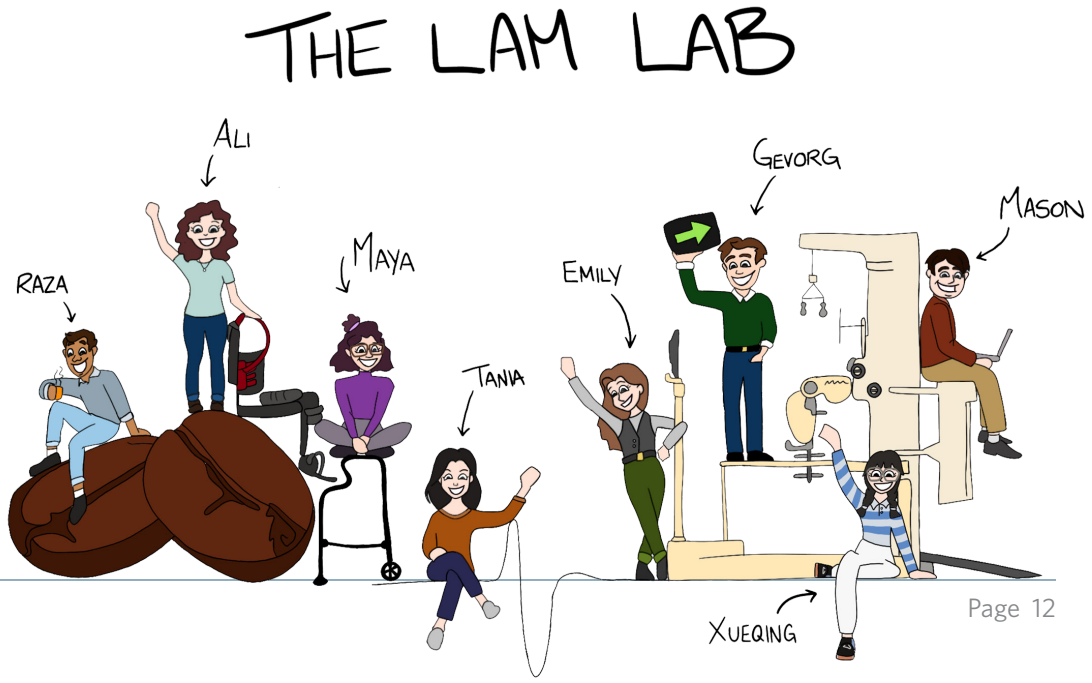
Programs affected by pandemic

Due to COVID-19 restrictions, ICORD was unable to host any in-person events, international scholars, or visiting speakers. We were sad to cancel the 2020 Summer Research Program for Indigenous Youth (although all students accepted into the 2020 program were invited to take part in the 2021 program).

ICORD's research programs were severely impacted: discovery-science labs and human-based research programs, including clinical trials, were forced to suspend (with a few exceptions for urgent projects). Project workflows had to shift from in-person to online collaboration. PPE for on-site work, once it was allowed again, was difficult to obtain and not included in research grant budgets. Faculty members who were scheduled to teach in the 20-21 academic terms spent many hours re-working lectures for online delivery. Administrative

"We could not collect any new data from participants after March 2020, except for some pilot data (from other lab members). At the same time, we were able to dedicate our time to completing older projects and manuscripts and developing new protocols."

- Tania Lam



staff wrote many iterations of safety plans and research resumption requests. Many people struggled to balance work and family responsibilities while working from home. Momentum in many labs was lost.

On the positive side, many research teams had time to focus on analyzing data, writing manuscripts, and submitting grants. With conferences going virtual, it was possible for faculty, staff, and trainees to participate in a wider variety of local, national, and international scientific events. Some researchers started COVID-related projects (including Drs. Eng, Krassioukov, Shadgan, Wellington, and Willerth). Everyone is looking forward to getting back to "normal."

"Last year I had to suspend all visits for clinical trials. During the resumption phase my lab incurred additional expenses for personal protective equipment and gowns which was not part of any previous research funding and at times difficult to procure. There were limitations on the number of individuals from my team that could be on site at any given time, which introduced complications in training and teaching of my students. Probably the biggest impact was the loss of momentum of my projects, in terms of both enrollment and applications for funding."

- Andrei Krassioukov

PARC UPDATE:

The **Yuel Family Physical Activity Research Centre** (PARC) was closed in March 2020 due to the pandemic. Because the 400+ participants rely on exercise to manage their existing impairments and prevent secondary impairments, many reported increased pain and decreased function. PARC's 60 student volunteers also reported feeling isolated and lacking opportunities to engage in meaningful activities. The PARC team quickly launched online exercise classes designed and led by students, and developed a library of online videos with exercises that can be done at home and with limited equipment. These classes were very popular with community members and were expanded to include individuals outside of Vancouver through collaborations with disability service organizations including Praxis and SCI BC. The online classes also provided students with opportunities to develop new skills.

PARC personnel had the opportunity to connect online with the Martin Ginis lab at ICORD-O and the Revved Up Program at Queen's University. Several PARC students became trained in physical activity counseling and provided phone support to the SCI community. In September of 2020, PARC was able to reopen for limited in-person visits following a strict COVID safety plan.

Also in September 2020, PARC Manager Milly Zaletelj and faculty advisor Dr. Andrea Bundon embarked on a UBC Engineering capstone project which brought a group of engineering students together with Chad Leaman, Director of Innovation at the Neil Squire Society and gaming expert Daniel Feltrin from Microsoft. The students designed an arm cycle controller with the goal of providing an accessible, in-home exercise solution for people with SCI that allows multi-directional upper body movement. In addition to providing an accessible exercise solution, another exciting goal is to connect controller-users through online gaming and enhance their community and social interaction. The students worked on their project at PARC after hours, when PARC users and volunteers had left for the day. The arm cycle is now installed at PARC and facility users will soon have a chance to try it out.

PUBLICATION HIGHLIGHTS:

Warner F, Cragg JJ, Jutzeler CR, Grassner L, Mach O, Maier DD, Curt A, Kramer JK. Association of timing of gabapentinoid use with motor recovery after spinal cord injury. *Neurology* 2020; 95(24):e3412-e3419.

Pregabalin and gabapentin are medications indicated for neuropathic pain; however, animal evidence suggests that they could be beneficial with respect to other neurological outcomes. Using existsing clinical trial data, this observational study, this observational study by Drs. John Kramer and Jacquelyn Cragg and their teams showed that the administration of pregabalin/gabapentin soon after injury was associated with improved motor outcomes in the year after injury.

Gainforth, HL, Hoekstra, F, McKay R, Willms R, et al. Integrated Knowledge Translation Guiding Principles for conducting and disseminating spinal cord injury research in partnership. *Archives of Physical Medicine and Rehabilitation,* 28:S0003-9993(20)31155-2.

This paper by Dr. Heather Gainforth and her colleagues outlines the rigorous consensus-based process used to co-develop the first integrated knowledge translation (IKT) guiding principles for conducting SCI research in partnership. The principles are designed to support researchers and research users to avoid tokenism and engage more meaningfully in research. (see page 7 for more on this topic)

Jutzeler CR, Linde LD, Rosner J, Hubli, M, Curt A, & Kramer J. (2021). Single-trial averaging improves the physiological interpretation of contact heat evoked potentials. *NeuroImage,* 225, 117473.

The flow of sensory information from the periphery to the brain is disrupted after spinal cord injury. This can be assessed objectively through the application of electrophysiological outcomes. In this study, researchers in Dr. Kramer's lab demonstrated an improved method of evaluating and interpreting one such outcome, so-called "contact heat evoked potentials", revealing important physiological relationships with age and sex.

Williams AM, Manouchehri N, Erskine E, Tauh K, So K, Shortt K, Webster M, Fisk S, Billingsley A, Munro A, Tigchelaar S, Streijger F, Kim KT, Kwon BK, West CR. Cardio-centric hemodynamic management improves spinal cord oxygenation and mitigates hemorrhage in acute spinal cord injury. *Nat Commun.* 2020 Oct 15;11(1):5209.

This study challenges the current standard for managing blood pressure in people with SCI. Drs. Chris West and Brian Kwon and their teams demonstrated that following high-thoracic SCI, the heart's ability to contract is impaired, leading to reduced spinal cord blood flow. Currently, a patient being treated for acute SCI has their blood pressure managed using drugs that cause their blood vessels to constrict in order to increase blood pressure. In this study, the researchers used an experimental treatment targeting the heart to beat more powerfully, which increased the amount of blood ejected and also increased blood pressure.

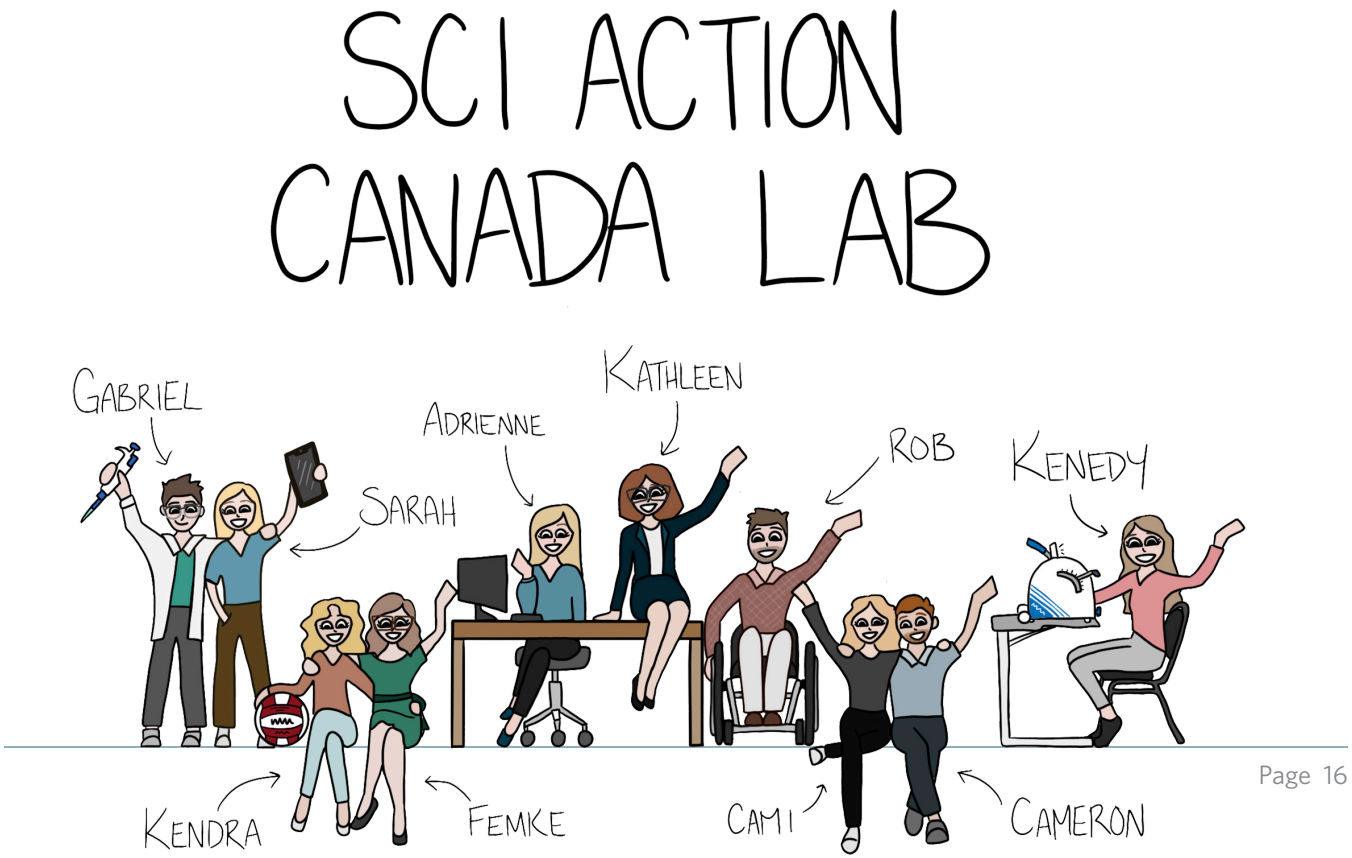
Bashir A, Abebe ZA, McInnes KA, Cripton PA, Wellington CL, et al. Increased severity of the CHIMERA model induces acute vascular injury, sub-acute deficits in memory recall, and chronic white matter gliosis. *Experimental Neurology.* 2020 Feb 1;324:113116.

The Cripton-Wellington team continued to advance its groundbreaking animal model of concussion called CHIMERA (Closed Head Impact Model of Engineered Rotational Acceleration) through enabling high energy impacts in murine models. This paper builds on the translational value of the CHIMERA model by enabling higher energy impacts that induce similar biomarker and brain pathology changes seen in human concussion.

PUBLICATION HIGHLIGHTS

Dr. Kathleen Martin Ginis and her team in the SCI Action Canada Lab published two highly-acclaimed papers in Spinal Cord *in 2020. "Translating the international scientific spinal cord injury exercise guidelines into community and clinical practice guidelines: a Canadian evidence-informed resource" was chosen as an Editor's Choice key paper highlighting best current research for the June 2020 issue, and "A pragmatic randomized controlled trial testing the effects of the international scientific SCI exercise guidelines on SCI chronic pain: Protocol for the EPIC-SCI trial" was a Readers' Choice in the July 2020 issue.*

SEE APPENDIX 1 FOR DETAILED PUBLICATIONS LIST



Liu H, Xiang Q-S, Tam R, Dvorak AV, Kolind SH, MacKay AL, Traboulsee A, Vavasour IM, Li DKB, Kramer JK, Laule C. Myelin water imaging data analysis in less than one minute. *Neuroimage.* 2020 Apr 15;210:116551.

This paper from Dr. Corree Laule's group proposed a novel machine learning method to dramatically reduce the data analysis time of an advanced MRI technique, known as the myelin water imaging (MWI). Dr. Kevin Liu's approach reduces computation time from hours to seconds without degrading the analysis results. This achievement improves the feasibility of MWI to be applied in clinical settings.

Whyte T, Melnyk AD, Van Toen C, Yamamoto S, Street J, Oxland TR, Cripton PA. A neck compression injury criterion incorporating lateral eccentricity. *Scientific Reports.* 2020 Dec;10(1)

Injury criteria identify how much acceleration or load a person can experience before they are injured. In this paper, by members of ICORD's Orthopaedic and Injury Biomechanics Group, the first comprehensive injury criterion that documents the potential for injury to the neck when combinations of compression and side bending are applied, was presented. This information can be used to design improved safety equipment to prevent broken necks and spinal cord injuries in head first impacts where the head is tilted to the side such as happens frequently in automotive rollovers and many sports.

Stukas S, Gill J, Cooper J, Belanger LM, Ritchie L, Tsang A, Dong K, Streijger F, Street J, Paquette SJ, Ailon T, Dea N, Charest-Morin R, Fisher CG, Dhall SS, Mac-Thiong JM, Wilson JR, Bailey C, Christie S, Dvorak MF, Wellington CL, Kwon BK. Characterization of CSF ubiquitin C-terminal hydrolase L1 (UCH-L1) as a biomarker of human acute traumatic spinal cord injury. *J Neurotrauma.* 2021 Jan 27.

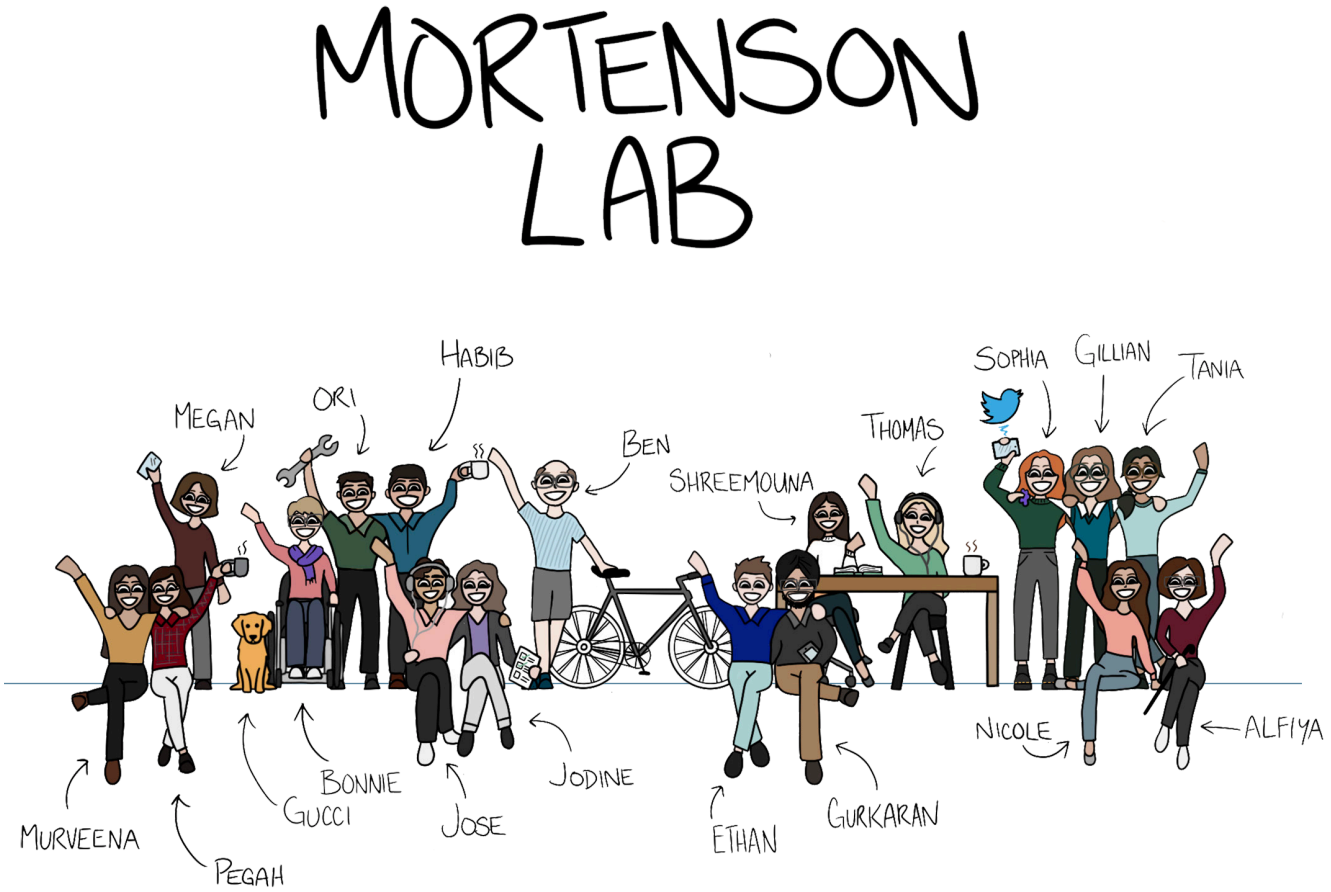
Biomarkers of acute SCI would be very valuable for classifying injury severity objectively and for predicting outcome. This is the first study to report on UCH-L1 as a potential biomarker of SCI, which is important because UCH-L1 has already been shown to be a biomarker of traumatic brain injury and has received FDA approval for use in traumatic brain injury patients.

Turner CT, Bolsoni J, Zeglinski MR, Zhao H, Ponomarev T, Richardson K, Hiroyasu S, Schmid E, Papp A, Granville DJ. Granzyme B mediates impaired healing of pressure injuries in aged skin. *NPJ Aging Mech Dis.* 2021 Mar 5;7(1):6.

Approximately 85% of people with SCI will develop a pressure injury (aka bed sores, pressure ulcers) at some point in their lifetime. Aging is a major impediment to normal healing of these wounds. Research by the Granville laboratory has identified a novel enzyme that contributes to age-impaired healing of pressure injuries.

Cheung A, Tu L, Manuchehri N, Kim KT, So K, Webster M, Fisk S, Tigchelaar S, Dalkilic S, Sayre E, Streijger F, Macnab A, Kwon B, Shadgan B. Continuous optical monitoring of spinal cord oxygenation and hemodynamics during the first seven days post-injury in a porcine model of acute spinal cord injury. *J Neurotrauma*, June 2020

Currently, one of the few aspects of critical care in which clinicians can improve neurologic outcomes is maintaining blood supply and maximizing oxygenation of acutely-injured spinal cord tissue. This study investigated the feasibility, function and accuracy of an implantable miniaturized optical sensor developed by Drs. Brian Kwon and Babak Shadgan to continuously monitor spinal cord hemodynamics in acute SCI patients for up to one week post-injury. This sensor provides information to guide clinicians in their treatment decisions and allows them to personalize the hemodynamic management of acute SCI patients to optimize neurologic outcomes.



Dr. Ben Mortenson and his team had an especially productive year, publishing thirty papers between April 1, 2020 and March 31, 2021 (with another nine either accepted or in-press, not to mention a book chapter and many conference abstracts).

BUILDING CAPACITY
WITH THE SUPPORT OF THE RICK HANSEN FOUNDATION

ICORD seed grants funded by the Rick Hansen Foundation since 2014 leveraged more than $20M in competitively-funded research grants by the end of the 2021 fiscal year. Between April 2020 and March 2021, seed grants were instrumental in the success of the following grant applications:

- $20K → US$100K: Drs. Carolyn Sparrey, Bonita Sawatsky, and Jaimie Borisoff leveraged data from their project Physiology and energetics of ergometer rowing for people with SCI into a new Craig H. Neilsen Foundation grant to continue their research. The collaborators are also developing a novel training program to assist trainers working with people with SCI.
- $18K → US$300K: Dr. Cornelia Laule, with ICORD collaborators Drs. Brian Kwon, Piotr Kozlowski, Wayne Moore, and Veronica Hirsch-Reinshagen, used data from their October 2020 seed grant project, *Advanced MRI techniques to measure spinal cord microstructure in vivo: development, reproducibility, and application to SCI*, to submit a successful application for a Craig H. Neilsen Foundation grant. They are hopeful that this work will clear the way to better imaging for SCI patients.
- $20K → US $1.65M: Drs. Christopher West and Brian Kwon collaborated on a seed grant-funded project in 2015, which led to a successful three-year US Department of Defense grant entitled *Offsetting Cardiac Dysfunction in Acute Spinal Cord Injury to Optimize Neurological Outcome. Improving cardiac and associated neurological outcomes is an important aspect of increasing quality of life for people with SCI.*
- $20K → $1.6M Dr. Matthew Ramer used pilot data generated through a seed grant to successfully apply for $1.6 million in SCI-related grant funding from the Craig Neilsen Foundation and CIHR.
- $20K → US$3.7M: Drs. Brian Kwon and Babak Shadgan were awarded a US$3.7M grant from the US Department of Defense SCI Research Program. The funding will be used to conduct a clinical trial evaluating a novel implantable biosensor based on Near-Infrared Spectroscopy (NIRS) technology, developed to monitor oxygenation and hemodynamics status of the injured spinal cord. The research started with pre-clinical work funded by a 2015 ICORD seed grant. These grants also provided the basis for their successful application to DARPA, of which US$9M come to ICORD.

generously supported by

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RESEARCH FACULTY NEWS

Dr. John (Kip) Kramer was the successful applicant for a tenure-track Assistant Professor position in the UBC department of Anesthesiology, Pharmacology, and Therapeutics (APT). This position was newly awarded by the Faculty of Medicine to APT as the result of a joint application of APT and ICORD. Dr. Kramer is excited for his laboratory to join the Department of Anesthesiology, Pharmacology, and Therapeutics, and to continue his research at ICORD. His current goal is to strengthen existing and build new collaborations with pain researchers across the province as well as with imaging experts at the Djavad Mowafaghian Centre for Brain Health to better understand factors underlying the development of chronic pain. Dr. Kramer is grateful to the Michael Smith Foundation for Health Research, Praxis, and the Rick Hansen Foundation for their support over the first five years of his career.

Dr. Dena Shahriari joined ICORD this year (see page 5).

Six new faculty members joined ICORD as Investigators: Drs. **Jacqueline Quandt, Josh Giles, Mohsen Akbari, Christopher Doherty, Erin Brown,** and **Sean Bristol**. Dr. Quandt is the Associate Director of the UBC MS Research Group at UBC and leads the Neuroinflammation Lab at the DMCBH and the Department of Pathology. Her research is focused on understanding the role of the immune system in both damage and repair of the brain and spinal cord as a result of neurodegenerative diseases, such as MS. Dr. Giles is an assistant professor of Mechanical Engineering at the University of Victoria. His research program focuses on novel methods for improving outcomes after surgical intervention as well as other novel technologies for improving rehabilitation. Dr. Akbari is the director of the Laboraty for Innovations in Microengineering at the University of Victoria. Drs. Doherty, Brown, and Bristol are nationally-renowned plastic surgeons with sub-specialty expertise in upper limb reconstructive surgical techniques, including nerve transfer surgery. These surgeons collaborate with Dr. Michael Berger, a physiatrist and Assistant Prof. in the Division of Physical Therapy (UBC) and PI at ICORD, who will provide the neurophysiological assessments of the people with cervical SCI who might benefit from these life-changing nerve transfer interventions.

RESEARCH FACULTY NEWS

Several ICORD faculty members were recognized for their research and teaching excellence:

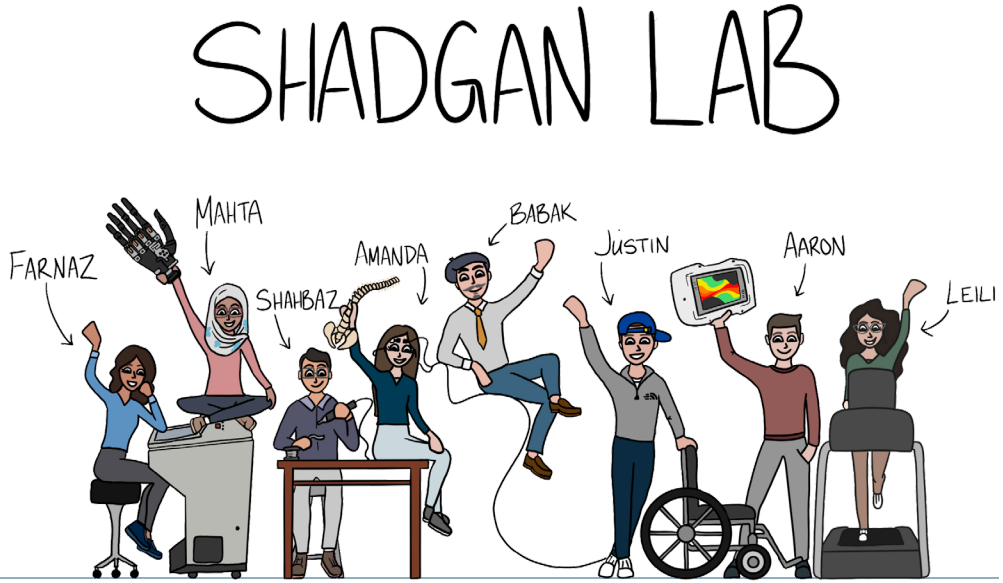
Dr. Janice Eng was appointed a University Killam Professor. This is the highest honour UBC can confer on a faculty member. A University Killam Professorship recognizes exceptional teachers and researchers who are leaders in their fields, and who have received international recognition for their talents and achievements.

Drs. Victoria Claydon and **Carolyn Sparrey** were two of the three "outstanding educators" recognized with 2020 Excellence in Teaching awards from SFU for their enthusiastic and innovative teaching, their ability to stimulate students to think creatively and critically, and their demonstrated caring for student learning.

Dr. Jacquelyn Cragg was awarded a Canadian Institutes of Health Research (CIHR) Tier 2 Canada Research Chair (CRC) in Open Data Science (see page 8).

Dr. Brian Kwon was one of three winners of the inaugural Craig H. Neilsen Visionary Prize (see page 6).

After starting as a Principal Investigator in 2019, Dr. Babak Shadgan has increased the size of his lab considerably with a team of enthusiastic award-winning young researchers including postdoctoral research fellow Dr. Leili Gazizadeh, who is funded by a MITACS fellowship; PhD student and CIHR Vanier Scholarship holder Amanda Cheung (co-supervised by Dr. Brian Kwon) who won a UBC President's Academic Excellence Initiatve award and numerous presentation prizes; and PhD student Justin Wyss who holds five scholarships and tuition awards including the Dr. Donald, Eleanor & Laurie Rix Biotechonology Graduate Award and a UBC President's Academic Excellence Initiatve award.



ICORD'S PRINCIPAL INVESTIGATORS

Dr. Michael Berger | *Clinical Assistant Professor, Physical Medicine & Rehabilitation, UBC* | **Focus:** Electrical stimulation, electromyography, nerve transfer, peripheral nervous system, physiatry.

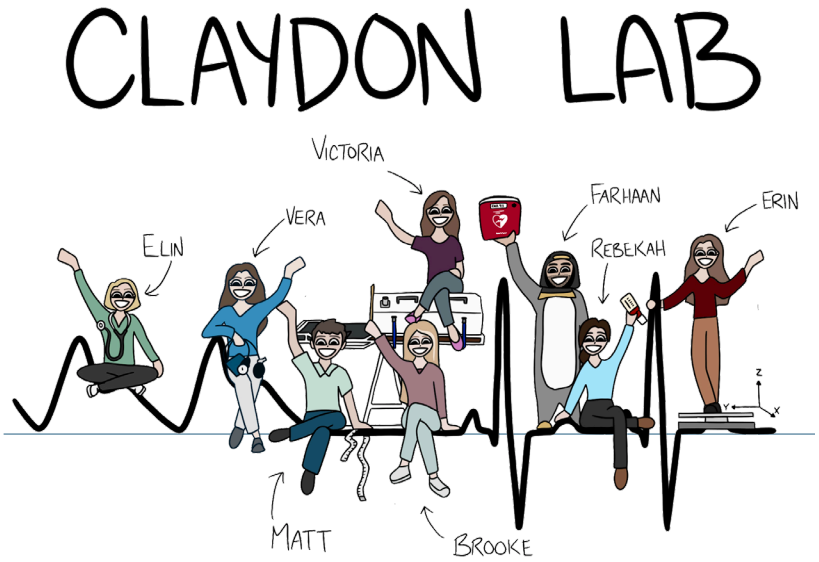
Dr. Gary Birch | *Executive Director, Neil Squire Society; Adjunct Professor, Electrical and Computer Engineering, UBC* | **Focus:** Ensuring assistive technology is accessible to people with disabilities.

Dr. Jaimie Borisoff | *Canada Research Chair in Rehabilitation Engineering Design; Research Director, British Columbia Institute of Technology; Adjunct Professor, Occupational Science and Occupational Therapy, UBC* | **Focus:** Increasing participation through improved accessible equipment design.

Dr. Andrea Bundon | *Assistant Professor, Kinesiology, UBC* | **Focus:** Community-based research, digital qualitative research, exercise, inclusion, paralympics, physical activity, qualitative methodologies, social participation, social support, sport.

2020 Excellence in Teaching award (SFU)

Dr. Victoria Claydon | *Professor, Biomedical Physiology and Kinesiology, SFU* | **Focus:** Impact of cardiovascular dysfunction on the quality of life of people with SCI.



Dr. Jacquelyn Cragg | *Assistant Professor, Pharmacology, UBC* | **Focus:** Data science, drug effectiveness, drug safety, epidemiology, SCI progression.

Dr. Peter Cripton | *Professor and Associate Director, Undergrad, School of Biomedical Engineering, UBC; Associate Member, Mechanical Engineering & Orthopaedics, UBC* | **Focus:** Mechanical and computational models of SCI; injury prevention.

Dr. Marcel Dvorak | *Professor, Orthopaedics, UBC; Cordula and Günter Paetzold Chair in Clinical SCI Research, UBC; Senior Medical Director, Vancouver Acute Services, Vancouver Coastal Health* | **Focus:** Adult traumatic spine injury surgery; optimizing clinical decision-making in acute SCI.

Fellow of the American Spinal Injury Assn. (ASIA)

Dr. Stacy Elliott | *Clinical Professor, Depts. of Psychiatry and Urologic Sciences, UBC; Medical Director, BC Centre for Sexual Medicine; Co-director, Vancouver Sperm Retrieval Clinic; Medical Director, Men's Sexual Assessment and Rehabilitation Service, Prostate Centre; Physician Consultant, GF Strong Sexual Health Rehabilitation Service* | **Focus:** Sexual health after SCI; autonomic dysfunction during sexual activity, pregnancy, and childbirth.

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ICORD'S PRINCIPAL INVESTIGATORS

Killam Professor (UBC) **Honorary doctorate,** (Univ. Laval)

Dr. Janice Eng | *Professor, Physical Therapy, UBC* | **Focus:** Web-based technologies designed to provide the SCI community with information about recovery and evidence-based treatments.

Dr. Susan Forwell | *Professor and Head, Occupational Science & Occupational Therapy, UBC* | **Focus:** Fatigue, pain, mobility, and employment among the SCI and traumatic brain injury populations.

Dr. Heather Gainforth | *Assistant Professor, Health and Exercise Sciences, UBC Okanagan* | **Focus:** behaviour change; health promotion; kinesiology; knowledge translation.

Dr. Aziz Ghahary | *Director, BC Professional Fire Fighters' Burn and Wound Healing Research Group; Professor, Surgery, Associate Member, Dermatology & Skin Sciences, UBC* | **Focus:** Development of therapeutics for chronic non-healing wounds and autoimmune diseases.

Dr. David Granville | *Professor, Pathology & Laboratory Medicine, UBC; Executive Director, Vancouver Coastal Health Research Institute and Associate Dean, Research (VCHRI), UBC Faculty of Medicine; Scholar of the Royal Society of Canada; Associate Director, BC Professional Firefighters' Burn and Wound Healing Research Laboratory, Plastic Surgery, UBC; Founder and Chief Scientific Officer, viDA Therapeutics Inc.; Adjunct Professor, Institute of Molecular Biology and Biochemistry, SFU* | **Focus:** Role of granzymes in the healing of injured tissue, inflammation, and neuronal damage.

Dr. Veronica Hirsch Reinshagen | *Assistant Professor, Pathology & Laboratory Medicine, UBC* | **Focus:** Glial cells in CNS disorders including traumatic SCI.

Dr. Andy Hoffer | *Professor, Biomedical Physiology and Kinesiology, SFU; Associate Member, Engineering Science, SFU; Founder and Chief Scientific Officer, Lungpacer Medical Inc.* | **Focus:** Prevention of the loss of voluntary diaphragm function in acute SCI; restoring diaphragm in ventilator-dependent, chronic SCI patients.

Meredith Marks Award forExcellence in Education (Can. Assoc. of Physical Medicine & Rehabilitation)

Dr.Alex Kavanagh | *Clinical Assistant Professor, Urology, UBC* | **Focus:** neurogenic bladder, pelvic reconstructive surgery, electrical stimulation of the central nervous system.

Dr. Piotr Kozlowski | *Associate Director, Magnetic Resonance Imaging Research Centre, UBC; Associate Professor, Radiology and Urologic Sciences, UBC; Associate Member, Physics and Astronomy, UBC; Research Scientist, Vancouver Prostate Centre* | **Focus:** Magnetic resonance imaging for the measurement of white matter damage.

Dr. John Kramer | *Assistant Professor, Anesthesiology, Pharmacology, and Therapeutics, UBC; Scholar, Michael Smith Foundation for Health Research* | **Focus:** Neuropathic pain medication and neurological recovery in SCI; open-access clinical trial data.

Dr. Andrei Krassioukov | *Professor, Physical Medicine & Rehabilitation, UBC; Spinal Cord Injury Rehab Rehabilitation Chair and Associate Director, Rehabilitation Research, ICORD; Staff physician, Spinal Cord Program, GF Strong Rehabilitation Centre; President, American Spinal Injury Association (ASIA)* | **Focus:** Management of autonomic dysreflexia after SCI; development and implementation of international Paralympic classifications.

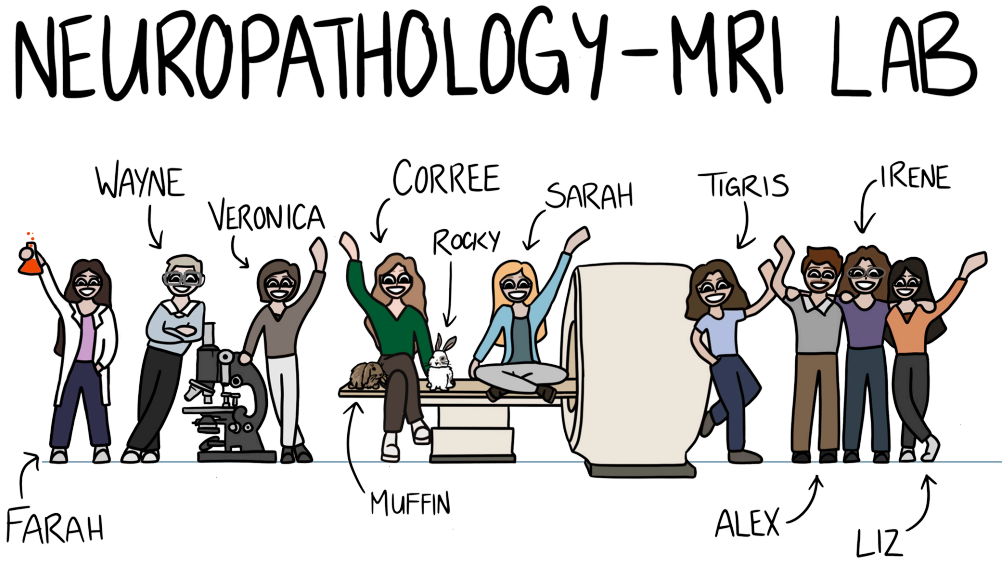
Craig H. Neilsen Visionary Award

Dr. Brian Kwon | *Canada Research Chair in Spinal Cord Injury; Professor, Orthopaedics, UBC; Spine Surgeon, Vancouver Spine Program, Vancouver General Hospital; Associate Director, Clinical Research, ICORD; Director, Vancouver Spine Research Program,*

Marcel Dvorak Chair in Spine Trauma, Vancouver General Hospital | **Focus:** Proteomic, metabolomic, and genomic changes occurring after acute SCI; International SCI Biobank.

Dr. Tania Lam | *Professor, Kinesiology, UBC* | **Focus:** Exercise interventions for urogenital health after SCI; robotic exoskeletons for rehabilitation.

Dr. Cornelia Laule | *Associate Professor, Radiology and Pathology & Laboratory Medicine, UBC; Associate Director, Education, ICORD* | **Focus:** Magnetic resonance imaging for quantitative measurements of myelin in the brain and spinal cord.



The Neuropathology-MRI Lab includes Drs. Wayne Moore, Veronica Hirsch-Reinshagen, and Corree Laule as well as their students and technical staff.

Dr. Kathleen Martin Ginis | *Professor, Health & Exercise Sciences, UBC Okanagan; Director, SCI Action Canada; Principal Investigator, Canadian Disability Participation Project; Fellow, National Academy of Kinesiology* | **Focus:** Physical activity behaviour change after SCI; increasing physical activity participation in the SCI community.

Dr. William Miller | *Professor, Occupational Science & Occupational Therapy, UBC; Associate Dean, Health Professions Education, UBC* | **Focus:** Optimizing mobility through the use of assistive technology.

Dr. Patricia Mills | *Clinical Assistant Professor, Physical Medicine & Rehabilitation, UBC* | **Focus:** Management of cardiovascular health and spasticity after SCI.

Dr. Wayne Moore | *Clinical Professor, Pathology & Laboratory Medicine, UBC* | **Focus:** Basic histopathology and immunopathology behind SCI; pathogenesis of multiple sclerosis.

CAOT award for Innovative Practice

Dr. W. Ben Mortenson | *Associate Professor, Occupational Science & Occupational Therapy, UBC; Adjunct Professor, SFU* | **Focus:** Community participation among those with SCI; scooter-skills training on safety and participation.

Dr. Mark Nigro | *Director, Provincial Organ Retrieval Program; Surgical Director of Renal Transplant, Vancouver General Hospital; Co-Director, Vancouver Ejaculatory Dysfunction Clinic; Clinical Professor, Dept. of Urologic Sciences, UBC* | **Focus:** Home monitoring to reduce urinary tract infections.

ICORD'S PRINCIPAL INVESTIGATORS

Dr. Ipek Oruc | *Associate Professor, Dept. of Ophthalmology & Visual Sciences, UBC* | **Focus:** Brain mechanisms behind higher-level vision; visual dysfunction caused by brain disorders (e.g., prosopagnosia, autism spectrum disorder).

Dr. Tom Oxland | *Professor, Orthopaedics and Mechanical Engineering, UBC; Associate Director, Discovery Science, ICORD* | **Focus:** Evaluation of mechanical parameters to predict the degree of damage from SCI.

Dr. Matt Ramer | *BC Neurotrauma Chair, ICORD; Associate Professor, Dept. of Zoology, UBC* | **Focus:** neuronal response to injury; repair mechanisms in the injured spinal cord.

Dr. Bonita Sawatzky | *Associate Professor, Orthopaedics, UBC* | **Focus:** Optimizing wheelchair functionality and use; longitudinal study of adults with Arthrogryposis Multiplex Congenita.

Dr. Babak Shadgan | *Assistant Professor, Orthopaedics, UBC; Scholar, Michael Smith Foundation for Health Research* | **Focus:** bio-sensing; clinical biophotonics; musculoskeletal and sports medicine; near-infrared spectroscopy; neuroprotection; translational research.

New ICORD Principal Investigator

Dr. Dena Shahriari | *Assistant Professor, Orthopaedics, School of Biomedical Engineering, UBC* **| Focus:** Biomaterials; Implantable sensors; Nerve repair; Neural interfaces; Organ augmentation; Smart materials.

2020 Excellence in Teaching award (SFU)

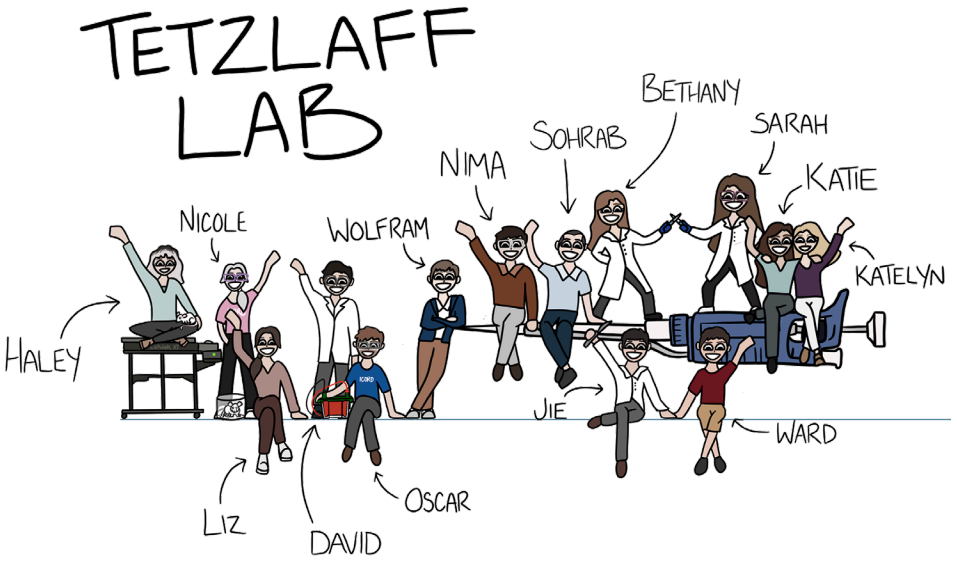
Dr. Carolyn Sparrey | *Associate Professor, Mechatronics System Engineering, School of Engineering Science, SFU* | **Focus:** Improvement of animal injury models; wheelchair safety engineering.

Dr. Lynn Stothers | *Professor, Urologic Sciences, and Member, Depts. of Healthcare and Epidemiology, and Anesthesiology, Pharmacology and Therapeutics, UBC* | **Focus:** Improvement of bladder health after SCI.

Victor A. Politano Award (American Urologic Assn.)

Dr. John Street | *Associate Professor, Orthopaedics, UBC; Spine Surgeon, Vancouver Spine Program, Vancouver General Hospital* | **Focus:** Minimization and accurate recording of adverse events in SCI population.

Dr. Wolfram Tetzlaff | *John & Penny Ryan BC Leadership Chair in Spinal Cord Research; Professor, Zoology and Surgery, UBC; Director, ICORD* | **Focus:** Protection against secondary neural damage after SCI; facilitation of neural repair.



ICORD'S PRINCIPAL INVESTIGATORS

Dr. Darren Warburton | *Co-Director, Physical Activity Line; Co-Director, Physical Activity Promotion and Chronic Disease Prevention Unit, UBC; Professor, Kinesiology, UBC* | **Focus:** Effects of physical activity, exercise, and training on cardiovascular health.

Dr. Cheryl Wellington | *Professor, Pathology and Laboratory Medicine, UBC* | **Focus:** Mechanisms of neurodegeneration and injuries to the central nervous system.

Dr. Christopher West | *Associate Professor, Southern Medical Program, UBC Okanagan* | **Focus:** Mechanisms of changes to cardiovascular health in response to SCI; physical activity and exercises to mitigate cardiovascular damage.

Dr. David Whitehurst | *Assistant Professor, Faculty of Health Sciences, SFU* | **Focus:** Health economics; quality-of-life assessments for SCI population.

REACH Award for Excellence in Engineering Partnerships (University of Victoria)

Dr. Stephanie Willerth | *Professor, Mechanical Engineering and Div. Medical Sciences, University of Victoria; Member, Centre for Advanced Materials & Related Technology* | **Focus:** Personalized neural tissue and biomaterial scaffolds for the treatment of neurological damage caused by SCI.

Dr. David Wilson | *Associate Professor, Orthopaedics; Associate Member, Mechanical Engineering, UBC* | **Focus:** Joint mechanics; improvement of surgical treatments for SCI.

Dr. Lyndia Wu | *Assistant Professor, Mechanical Engineering, UBC; Scholar, Michael Smith Foundation for Health Research* | **Focus:** concussion; head impact sensing; soft tissue biomechanics; traumatic brain injury.

Dr. E. Paul Zehr | *Professor & Director, Centre for Biomedical Research, Division of Medical Sciences, School of Exercise Science, University of Victoria* | **Focus:**
Neural control of ambulation;
science communication.

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ICORD'S PRINCIPAL INVESTIGATORS

Investigators
Dr. Phil Ainslie
Dr. Mohsen Akbari
Dr. Hugh Anton
Dr. Sean Bristol
Dr. Erin Brown
Dr. Mark Carpenter
Dr. Anita Delongis
Dr. Christopher Doherty
Dr. Josh Giles
Dr. Tal Jarus
Dr. Shannon Kolind
Dr. Tim O'Connor
Dr. Scott Paquette
Dr. Jacqueline Quandt
Dr. Jane Roskams
Dr. William Sheel
Dr. Andrea Townson

Associate Members
Dr. Mike Boyd
Dr. Romeo Chua
Dr. Jens Coorsen
Dr. Kerry Delaney
Dr. Tim Inglis
Dr. Mohamed Javan
Dr. Andrew Laing
Dr. Nan Liu
Dr. Freda Miller
Dr. Michael Negraeff
Dr. Aaron Phillips
Dr. Miriam Spering
Dr. Paul van Donkelaar
Dr. Rhonda Willms

Emeritus Members
Dr. Tom Grigliatti
Dr. Catherine Pallen
Dr. John Steeves
(Founding Director)

Special thanks to **Maya Sato-Klemm** for creating all the drawings in this year's report!

icord

is a world-leading health research centre focused on spinal cord injury. From the lab-based cellular level of understanding injury to rehabilitation and recovery, our researchers are dedicated to the development and translation of more effective strategies to promote prevention, functional recovery, and improved quality of life after spinal cord injury. Located at Vancouver General Hospital in the Blusson Spinal Cord Centre, ICORD is supported by the Rick Hansen Foundation, UBC Faculties of Medicine and Science, and Vancouver Coastal Health Research Institute.

Rick Hansen Foundation

UBC FACULTY OF MEDICINE

Vancouver CoastalHealth Research Institute

Thank you for reading our 2020-21 Annual Report.

Prepared by: Cheryl Niamath, Katie Ashwell, Maya Sato-Klemm, Lowell McPhail.

For additional copies of this report or any other ICORD publication, please call 604-675-8844 or email admin@icord.org.

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