icord

annual report 2022-23

THE UNIVERSITY OF BRITISH COLUMBIA

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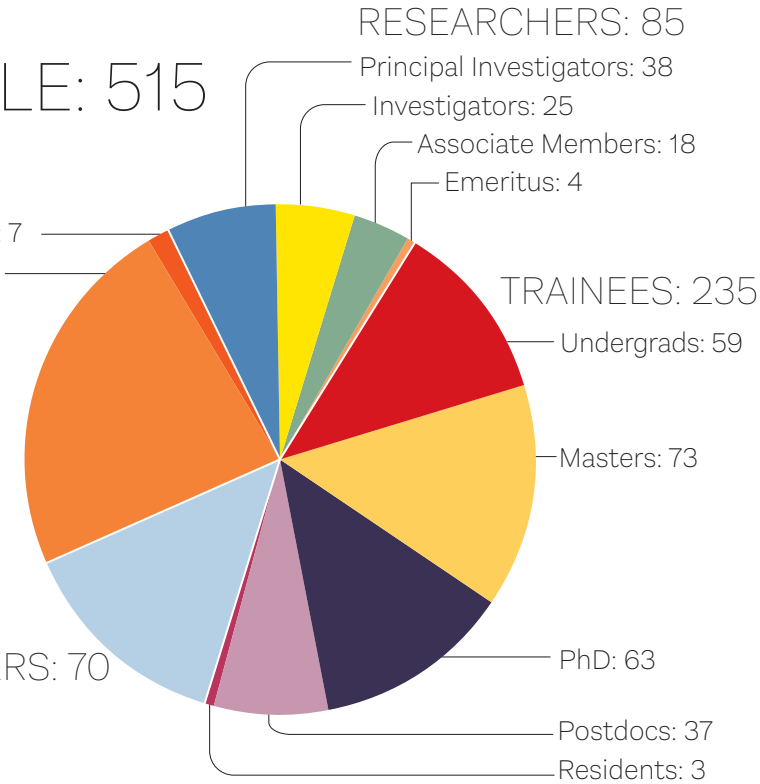
ICORD **Annual Report** 2022-23

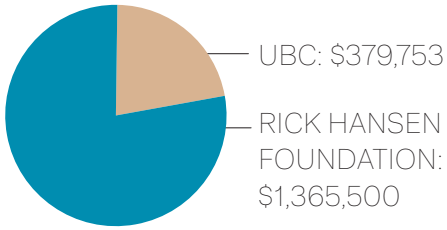
ICORD at a glance

April 1, 2022 to March 31, 2023

PEOPLE: 515

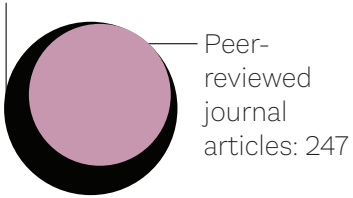


SUPPORT

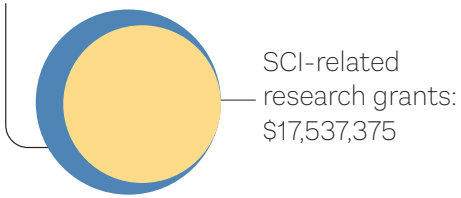


PRODUCTIVITY

TOTAL PUBLICATIONS BY ICORD RESEARCHERS: 369



TOTAL RESEARCH GRANTS HELD BY ICORD RESEARCHERS: $24,178,640



ICORD
Annual Report
2022-23

Introduction

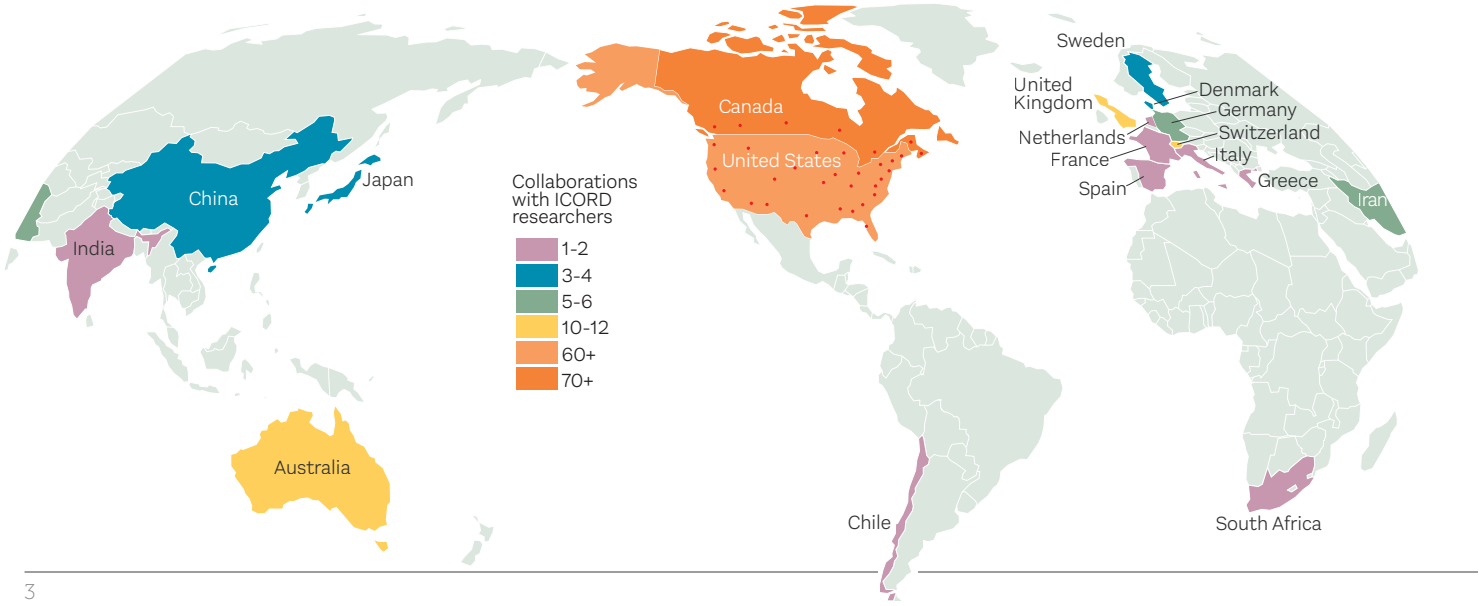
Welcome to ICORD's Annual Report, which covers the activities and accomplishments of our spinal cord injury research centre from April 1, 2022 to March 31, 2023.

This was a busy and productive year. On top of supporting myriad research activities and organizing large events, we also underwent a favourable external centre review, in addition to a space review. The external centre reviewers described ICORD as an "outstanding multidisciplinary SCI-focused unit with high productivity and strong international impact, as evidenced by consistent metrics."

In the following pages, you will read about the interdisciplinary work conducted by ICORD's brilliant and dedicated researchers, trainees, and staff, who are passionate about making spinal cord injury preventable, livable, and curable. Their work has global reach: ICORD Principal Investigators represent 21 departments at UBC (Vancouver and Okanagan), SFU, BCIT and the University of Victoria, and they have a combined 220+ research collaborations at more than 100 institutions across seven Canadian provinces, 22 American states, and 17 countries around the world.

This work would not be possible without the partnership of the Rick Hansen Foundation, the University of British Columbia, and Vancouver Coastal Health Research Institute. These three institutions have supported ICORD since our inception, and for this we are sincerely grateful.

Speaking of gratitude, we would like to extend a heartfelt thank you to Dr. Wolfram Tetzlaff, who completed his ten-year term as Director in 2023. We are incredibly appreciative of the time, energy, wisdom, and enthusiasm that he committed to ICORD during his tenure. He looks forward to focusing on his own research in the coming years.



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2022-23 highlights

Rehabilitation assistance in Ukraine

Dr. Krassioukov and colleague arriving in Lviv

In the Fall of 2022, Dr. Andrei Krassioukov answered a call for SCI specialists, especially those who speak Ukrainian or Russian, to join a team being assembled by the World Health Organization (WHO) to help to establish a new Ukrainian national spinal cord injury rehabilitation centre for military personnel injured during the war. He joined an interdisciplinary WHO team of three physicians, two occupational therapists, a physiotherapist, a nurse, and a psychologist from Canada, the United Kingdom, Norway, Sweden, Italy, and Australia. Over several trips, Dr. Krassioukov worked with physicians and hospital administration to help define inclusion and exclusion criteria for admission, translated some important clinical guidelines for the management of acute SCI into Ukrainian, and provide education on how to appropriately use the guidelines. He also provided training on assistive technologies and sexual dysfunctions following SCI. A longer report of Dr. Krassioukov's work in Ukraine was published in the Winter 2023 issue of the *ICORDian Community Newsletter*.

New Research Liaison position

To assist people interested in taking part in research studies but unsure how to get involved, ICORD piloted a new Research Liaison position in the Fall of 2022. Masters student Nicole Bailey was hired into the position and worked with 27 clients over 9 months. Interested people contacted Nicole, and over a few short phone conversations, she determined their research interests and some common study inclusion and exclusion criteria. From there she created tailored lists of research studies with contact information for each one. Nicole also gave regular presentations to staff and clinicians at the GF Strong Rehabilitation Centre. The position will be continued in 2023/24.

Success in grant competitions

Several ICORD researchers were successful in the **Canadian Institutes for Health Research** competitions this year:

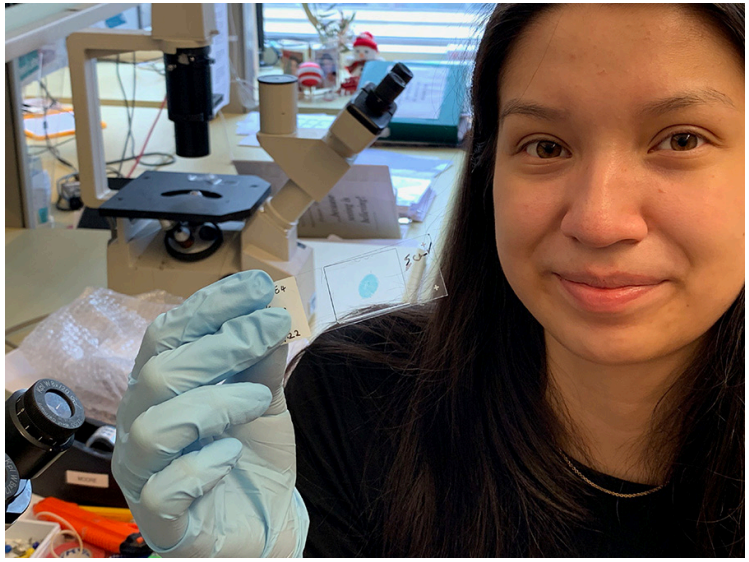
- **Dr. David Granville** received $872,100 over 5 years to study novel mechanisms and therapeutic approach for aging-related pruritus. He also won a program grant award of excellence in research in aging. Co-investigators include Philipp Lange, Yunyuan Li, Layla Nabai and Matt Ramer.
- **Dr. Tania Lam** received $569,924 over 4 years for the PELvUS Study - Pelvic floor Exercise to Lessen Urinary incontinence and Sexual dysfunction in people with spinal cord injury. Co-investigators include Andrei Krassioukov, Andrea Bundon, Matthias Walter, Stacy Elliott, Calvin Wong.

- **Dr. Peter Cripton** and his colleague Dr. Gunter Siegmund received $539,324 over 4 years to study neck muscle and head-neck dynamics in rollover crashes.
- **Drs. Cheryl Wellington, Peter Cripton, Piotr Kozlowski and Lyndia Wu** were awarded $1,293,201 over 4 years for their project using translational biomarkers to define whether plane of motion and complexity of head kinematics modifies biomarker and neuropathological responses to concussion in mice and humans.

Two ICORD researchers received **Michael Smith Health Research BC** Convening and Collaborating program funds: ICORD Investigator **Dr. Carolyn Sparrey,** for co-creating a research agenda for health technology innovations. Principal Investigator **Dr. Heather Gainforth** partnered with SCI-BC to co-develop a smoking cessation intervention for people with SCI.

Summer research program for Indigenous youth

ICORD's summer program for Indigenous youth expanded to UBC-Okanagan in the summer of 2022. The program aims to Introduce Indigenous youth to neuroscience and spinal cord injury research in a fun and supportive environment before they need to make decisions about high school electives and higher education, normalize Indigenous participation within research teams, and foster greater awareness of barriers faced by Indigenous peoples in pursuit of careers in academic research. Students are paid monthly salaries and receive transit passes in order to reduce barriers to participation. Undergraduate alumni of the program return as summer research assistants and peer mentors.
From one student at UBC-Vancouver in 2018, the program grew to four students in Kelowna and thirteen in Vancouver in 2023, and interest continues to grow. Support for student salaries is provided by ICORD, the UBC School of Biomedical Engineering, and the International Brain Research Organization, as well as by individual faculty members through grants or donations.



Above: end-of-term poster presentation; below: Shana George in the Tetzlaff Lab.

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Events

With pandemic restrictions eased, ICORD was able to host several successful in-person events:

MeetICORD

Planned and presented by ICORD's Trainee Committee with the assistance of ICORD's communications team, ICORD's first large in-person event since March 2020 took place on September 15, 2022. 207 people from 15 different countries who had come to Vancouver to participate in the International Spinal Cord Society (ISCoS) conference later in the week gathered to hear keynote talks as well as three-minute talks by researchers and people with lived experience of SCI. Praxis, SCI BC, SCIRE, Reach BC, and several ICORD labs presented info/demonstration tables, and all the guided tours of the BSCC were fully-booked.

SUPPORTED BY: Rick Hansen Foundation

ICORD Trainee Symposium

On October 18, 2022, ICORD Trainees hosted their annual symposium. The hybrid in-person/virtual event was a success with over 96 registered participants. The event featured trainee seminars, a keynote seminar by Dr. Michele Basso of Ohio State University, and seminars by ICORD faculty Drs. Stephanie Willerth and Peter Cripton. Following the trainee talks and data blitz session, participants enjoyed a lively poster session with 30 trainee and staff posters, as well as six resource tables set up by Graduate Student Services, ASDa, ICORD Trainee Committee, Data Binge, Indigenous Student Summer Program, the ICORD Research Liaison, and REACH BC.

SUPPORTED BY: Rick Hansen Foundation

Women in Science

On February 10, 2023, ICORD hosted a special event in honour of the **UN International Day of Women and Girls in Science.**
"Women and girls play a critical role in science, technology, engineering and mathematics communities and their participation should be strengthened. We are underrepresented in these careers and it has a trickle-down impact on the type of research that takes place," said ICORD Managing Director Dr. Nancy Thorogood in her welcoming remarks. According to the Canadian Association for Girls in Science (CAGIS), women

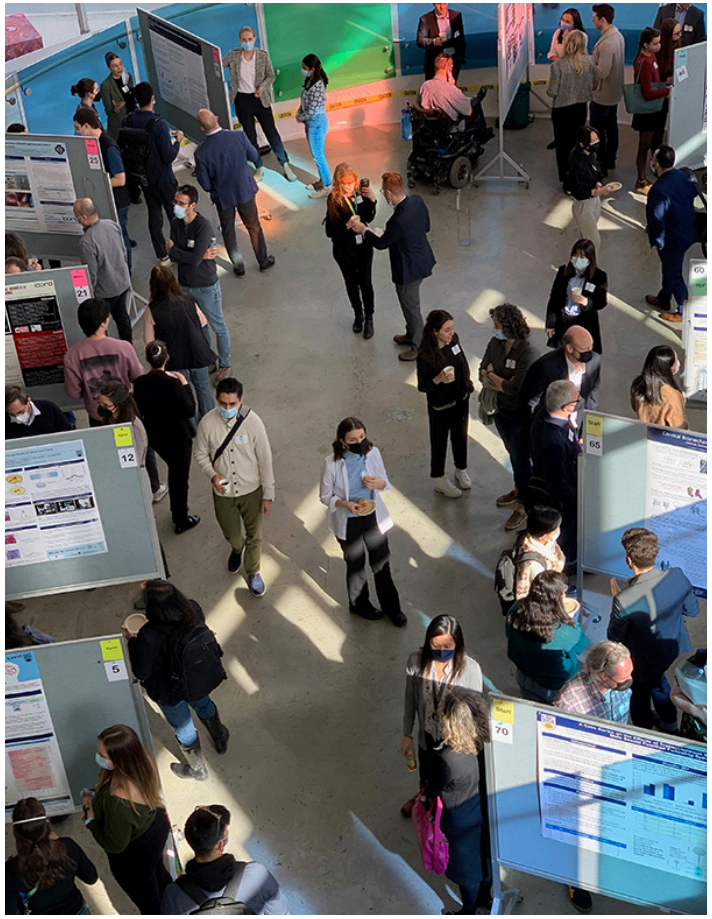
Above: MeetICORD; below: Celebration of Women & Girls in Science

make up only 23% of science and technology workers and fewer than 4% of trades workers in Canada. Yet science, technology, trades, engineering, and mathematics (STEM) occupations are among the highest-paid and fastest-growing occupations in the country. At ICORD, women make up 44% of Principal Investigators, and many trainees are women. Girl Guides and the Society for Canadian Women in Science and Technology (SCWIST) both set up information booths at the event, and several ICORD labs ran fun demonstrations and hands-on activities for younger participants.

2023 Annual Research Meeting

ICORD hosted its 20th Annual Research Meeting (ARM) on March 8 and 9, with a record 187 people in attendance over the two days. Keynote talks were given by Alexander (Sasha) Rabcheveky from the University of Kentucky, and Julien Cohen-Adad from the Université de Montréal. ICORD researchers Drs. Brett Hilton, Stacy Elliott, Jacquelyn Cragg, John Madden, Ipek Oruc, Jasmin Ma, Victoria Claydon, and Jaimie Borisoff presented short research talks. Saina Nemati, Keili Shepherd, Robert Buren, and Nikolai Lesack gave mini-trainee talks. Dr. Heather Gainforth and Alanna Shwed led a lively discussion on Integrated Knowledge Translation, and trainees and staff presented 74 research posters (another record!).

SUPPORTED BY: Rick Hansen Foundation



Above: ARM poster presentation; below: Rick Hansen, Wolfram Tetzlaff, Sasha Rabcheusky at the ARM.

Clinical studies

Between April 2022 and March 2023, ICORD researchers initiated recruitment for 19 new human-based research studies, ranging from surveys to exercise interventions:

Exploring the impact of front-end attachments on eye gaze patterns. Researchers in Dr. Ben Mortenson's lab are exploring how the use of front-end wheelchair attachment devices, such as the Freewheel, impacts users' eye gaze patterns. **Cycling Infrastructure Project.** Dr. Mortenson and his team are also interviewing people with disabilities who use mobility devices to learn more about how they navigate cycle pathways with different devices, and how to improve cycling infrastructure for a variety of users including those with mobility devices.

Online training on spinal cord injury physical activity counselling. Researchers in Dr. Heather Gainforth's lab are seeking feedback on an online training modules on the best practices for SCI physical activity counselling. **Co-developing a smoking cessation intervention for people with SCI.** The Gainforth lab is also seeking input and feedback on a smoking cessation intervention for people with SCI that they are co-developing.

Exploring empathy amongst individuals with SCI or TBI. Dr. Bill Miller and his team are studying the role of empathy in the daily lives of individuals who have an acquired SCI and/or traumatic brain injury (TBI).

Heart rate variability and anxiety during urinary bladder catheterization. Dr. Andrei Krassioukov and his team want to better understand and improve the experience of intermittent catheterization, which is the preferred method for emptying the bladder after SCI. **FashionABLE: Adaptive fashion guide for the people, by the people with SCI**. The Krassioukov Lab is also surveying people with SCI and health care professionals involved in the care of individuals with SCI to inform an open-source clothing pattern library and web-based resource to facilitate increased diversity in clothing options for the SCI community.

Effect of behavioural tasks on capsaicin and mechanical pain. Researchers in Dr. John Kramer's Lab are investigating the relationship between behavioural tasks and pain from capsaicin cream, with the hope of better understanding factors that influence pain perception. **Pain sensitivity and brain chemistry in participants without chronic pain**. The Kramer Lab is also using magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS) scan to investigate pain sensitivity in participants ithout chronic pain, SCI, or other major health conditions, to improve treatments for chronic pain conditions.

Ultrasound evaluation of muscle health following cervical spinal cord injury. Researchers in Dr. Mike Berger's lab are comparing forearm and hand muscle health in people with subacute cervical SCI and uninjured people to quantify how these muscles are affected in people with cervical SCI.

Opinions on wearable sensors to detect sudden cardiac arrest. Researchers in Dr. Babak Shadgan's lab are interested in understanding user compliance to using wearable devices with regards to perceived risk of experiencing a cardiac arrest, and user design preferences in terms of the dimensions and location of a potential devicee. **The impact of a new method of exercise on muscle development in people with SCI.** The

Shadgan Lab is also studying the effects of an 8-week low-intensity blood flow restriction exercise program on strength, mass, endurance, and function of wrist muscles in adults with incomplete SCI.

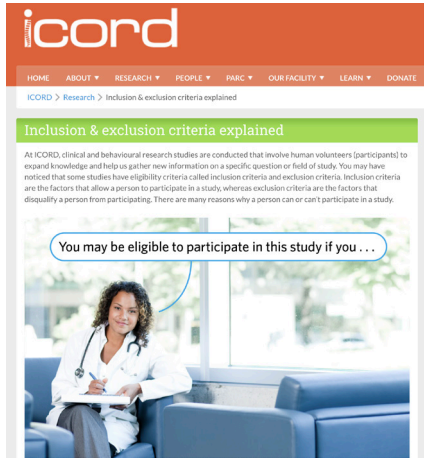
Sex differences in cardiac function in individuals with high-level SCI. Drs. Chris West and Alexandra Williams are investigating whether there are differences between the male and female heart in individuals with SCI, in comparison to any sex-related differences that exist in uninjured individuals.

Impact of spinal cord injury on cardiorespiratory interactions. Dr. Victoria Claydon and her research team are studying how SCI may impact the relationship between breathing and cardiovascular function, and to characterise the interactions between breathing-related cardiovascular regulation and obstructive sleep apnoea.

Using Near Infrared Spectroscopy (NIRS) on the Pelvic Floor Muscles. This study, by Dr. Lynn Stothers and her research team, uses a device that uses light to determine the fitness of muscles in the body (NIRS) to investigate whether exercise makes a difference in the amount of oxygen in muscle fibres of the pelvic floor. **Using Near Infrared Spectroscopy (NIRS) on the Bladder.** The Stothers Lab is also looking at using NIRS to determine how the bladder muscle uses oxygen in order to develop safe and non-invasive techniques for studying bladder function without the use of catheters in people with neurological injuries or disorders.

The Joy Active Study. This study by Dr. Kathleen Martin Ginis and her team aims to gain a better understanding of experiences and perceptions of individuals participating in an exercise program for adults with neurological disorders who have mobility impairments. **Improving exercise counselling for adults with spinal cord injury.** The Martin Ginis Lab is also studying experiences, perceptions, and preferences of adults with SCI who received physical activity counselling in order to develop modules to train counsellors best-practices for SCI physical activity counselling.

How do wheelchair platform lifts work for you? Dr. Jaimie Borisoff and his team are surveying wheelchair users on their experiences using stair lifts, enclosed lifts and unenclosed lifts to include in a report to the Canadian Standards Association with recommendations for improvements to the standard (B355) which controls how wheelchair lifts are designed, installed, and maintained.



Studies are posted on the ICORD website: icord.org/research/participate-in-a-study/

ICORD's Research Liaison offers personalized assistance for people interested in participating in research but unsure which studies would be appropriate (see page 3). To assist potential research participants, a page explaining inclusion and exclusion criteria was posted in June 2022.

SUPPORTED BY: Rick Hansen Foundation

Recruitment assistance is supported by the Rick Hansen Foundation through Spinal Cord Injury BC's recruitment coordinator (see page 11).

Rick Hansen Foundation supports capacity-building

SUPPORTED BY: Rick Hansen Foundation

The funding support provided to ICORD by the Rick Hansen Foundation (RHF) is vital. Not only are the direct results of the funding beneficial to the centre but the indirect benefits of the support are far-reaching. With shared tech support and equipment, seed grants, travel awards, seminars and international exchange programs, ICORD is an internationally-known centre where researchers and trainees want to come to do SCI research. We look forward to building on the foundation laid to further the shared goals of RHF in the future. We are sincerely grateful for the continued support of the Foundation for the following programs:

Seed Grants

Data generated from seed grant-funded pilot projects are used in applications to funding agencies for multi-year large scale projects to further the understanding of the treatment/cure of SCI. This investment in identified priority areas supports the vision to make SCI preventable, livable, and curable. Seed funds increase ICORD's research capacity in priority areas and foster collaboration and partnership to increase productivity. They increase competitiveness resulting in leverage for funding to do high quality research and develop new avenues of research.
Nine seed grants were awarded in Spring 2022 and Fall 2022. This brings the total to 93 seed grants awarded since 2014/15. Awards ranged from $10K to $20K.

> Support provided by the Rick Hansen Foundation is vital.

Travel Grants

With the relaxing of the pandemic restrictions, ICORD was once again able to host international scholars and send trainees to learn new techniques on exchange in other labs and present at scientific conferences.

International Exchanges

ICORD hosted seven international visitors and sent one ICORD trainee to the US for specialized training with funding support from the Rick Hansen Foundation. Beyond interacting and working with visitors in our labs, ICORD faculty, staff, and trainees were able to learn about the exchange projects through four talks and two poster presentations. The following international scholars visited ICORD: Hagen Kitzler (Technische Universitat Dresden University Hospital, Germany), Binata Joddar (University of Texas), Eleni Sinopoulou (University of California, San Diego), Daniel Hodgkiss (University of Birmingham, UK), Reuben Escorpizo (University of Vermont & Swiss Paraplagic Research, Switzerland), Alexander Rabchevsky (University of Kentucky), Lucie Bourguignon (ETH Zurich).

In addition, travel by two ICORD Trainees to undertake collaborative research was supported. Adam Doelman (Kwon Lab) travelled to the Lerner Research Institute, Cleveland Clinic and Dr. Numaira Obaid (Sparrey Lab) travelled to UCSD.

Trainee Travel Awards

The trainees were excited about the opportunity to share their research results at conferences once again. A record number of applications were received, and 45 trainees had travel opportunities funded in the past year.

Central Participant Recruitment

When it comes to SCI research, a rate-limiting step has been the timely recruitment of participants with SCI. To overcome this, the partnership between ICORD and SCI BC was solidified to build interest by people with SCI to participate in ICORD research through knowledge translation (KT) activities and to recruit study participant through SCI BC's connections with their members. With support from RHF, the partnership continues to have a positive impact on meeting research demand for participation.

SCI BC promotes participation in ICORD research and to supports knowledge translation related to ICORD research activities directly to their active membership of over 2,900 people throughout the province, as well as through the Spin magazine (readership of ~16,000), website, and a very engaged social media community.

SCIRE

SCIRE (Spinal Cord Injury Research Evidence) is a free online resource that covers a comprehensive set of topics relevant to SCI rehabilitation and community reintegration. SCIRE reviews, evaluates and translates existing research knowledge into a clear and concise format to inform health professionals (SCIRE Professional) and other stakeholders (SCIRE Community) of best rehabilitation practices following SCI. This past year was the third year that funding from RHF directly supported SCIRE.

Highlights include:

- SCIRE partnered with American Spinal Injury Association (ASIA) Primary Care group, the Centre for Family Medicine in Kitchener ON, the UBC Dept. of Family Practice, and SCI-BC to create brief, evidence-based material specifically for Primary Care practitioners. Primary Care and Bladder section is already live.
- SCI Community is now hosting the world's first Breastfeeding Guidelines for Mothers following SCI
- SCI Community website continued to add useful content for people with SCI and their families, with 55 articles published, 17.5K page views and 1.2K article downloads. New articles added included: a review on Body-Weight Supported Treadmill Training (BWSTT), Physical Activity and Adaptations for people with SCI, as well as SCIRE's popular and practical pieces on Adapted Driving, Wheelchair Maintenance, and Travelling with SCI
- SCIRE Community has maintained and increased an active social media presence with frequent promotion of new articles and SCIRE news.

PARC

The Yuel Family Physical Activity Research Centre (PARC) is ICORD's most successful community engagement initiative. Located on the first floor of the Blusson Spinal Cord Centre, PARC provides community members with SCI and related impairments with a space where they can be physically active and meet their exercise goals. Compared to similar facilities at other universities and/or health care facilities, PARC is unique in that community members are not required to register for a set program but are instead encouraged and supported to attend on a drop-in basis. The focus is on supporting participants to experience autonomy and choice regarding the frequency and type of exercise they engage in whilst still providing the support they need.

Research participant at PARC

After two years of pandemic-related restrictions and reduced programming, PARC was again able to operate at full capacity and was even been able to expand programming and introduce some new initiatives. A few notable initiatives include:

- **Online classes and in-person classes:** In addition to resuming in-person yoga, boxing, and spin classes, PARC continued to offer four online classes per week. Many members indicated that online classes helped them feel connected to the community when they couldn't attend in person. Online classes were also successful in engaging new participants and/or reconnecting with past participants who had moved out of the area.
- **Work Integrated Learning at PARC:** This year, the School of Kinesiology introduced *Work Integrated Learning* courses. These are classes that allows students opportunities to develop applied skills and competencies in community and workplace settings while earning credits towards their degree. Overseen by Dr. Jasmin Ma, ten students enrolled in the first PARC WIL class. This has allowed PARC to offer participants individualized exercise prescription, physical activity counseling and technique coaching.
- **Evening hours:** Starting in January 2023, PARC remained open until 7pm two evenings a week. These hours are intended to provide more accessibility for community members who work during the daytime and have been well attended.
- **New equipment:** Over the past year, PARC has added several pieces of equipment to provide greater opportunity to exercise for our participants, including an additional standing frame, pully handles, resistance bands and grip strengtheners.

International SCI Biobank

The International SCI Biobank (ISCIB) is a translational research resource consisting of a collection of biospecimens, images and data to support biomedical research and to ultimately improve patient outcomes following SCI. ISCIB

is an international, “poly-user” biobank, meaning that all biospecimens and their associated information are made available to researchers globally.
ISCIB has curated biospecimens and associated data from three distinct acute and chronic SCI participant consent categories: alive, alive and participating in another research study, and deceased. From the “alive” categories, cerebrospinal fluid, plasma, serum, and PAXgene Blood RNA tubes are collected, while cerebrospinal fluid and spinal cord tissue are collected from the “deceased” category.
ISCIB currently stores seventeen spinal cords from deceased donors with SCI, four of which were collected between April 1, 2022 and March 31, 2023.
ISCIB held 25,869 aliquots of cerebrospinal fluid, 24,064 aliquots of serum, 7,682 aliquots of plasma, and 1,225 PAXgene Blood RNA tubes from a total of 287 participants. These include individuals diagnosed with acute or chronic SCI, with injury classifications from AIS A through AIS D, as well as uninjured (degenerative spinal disorder) control participants. The first paper describing the ISCIB was published in the Journal of Neurotrauma in July 2022:

> Hirsch-Reinshagen V, Velenosi A, Morris SR, Dong K, Samadi-Bahrami Z, Nassimbwa S, Abdelaziz E, Kozlowski P, Moore W, Laule C, Kwon BK. The International Spinal Cord Injury Biobank (ISCIB): A Biorepository and Resource for Translational Research. J Neurotrauma. 2022 Jul 26.

Shared Resources

Equipment

Funding from RHF supports shared scientific research equipment that is made available to all BSCC researchers, trainees, and staff. Combined, there is approximately $14 to $16M in research equipment at ICORD. RHF funding for service contracts to maintain and repair equipment is critical to maintain key, shared, state-of-the-art equipment and infrastructure. Examples of equipment directly supported by RHF include: electron microscope, confocal microscopes, two photon microscopes, light-sheet microscope, slide scanner, autoclaves, biosafety cabinets, water distillers, cryostats, icemakers, ultralow freezers, PARC gym equipment, metabolic carts, isoflurane vaporizers and cage washers. The shared equipment provides a cost-effective resource for users who may not otherwise have access to such equipment for their research.

Research Support

The provision of vital support to maintain sensitive equipment and develop and teach research techniques to researchers enables researchers to learn new techniques quickly and rapidly increase their productivity. ICORD’s full-time Facilities Manager, Yuan Jiang, is partially supported by RHF. Yuan is a vital resource who oversees equipment repair and maintenance. He also provides instruction and training to new researchers, as well as co-chairing our local safety committee and supporting safety initiatives. Also supported by RHF funding, ICORD’s Senior Administrative Assistant, Katie Ashwell, and Finance Coordinator, Chandelle Coleman, support all investigators, trainees and research participants at ICORD and contribute to the ICORD community at the Blusson Spinal Cord Centre by allowing faculty and trainees to focus on their research goals.

Publication highlights

Papers from the past year that ICORD researchers are most excited about:

Dr. Mike Berger: *This paper describes the creation of a brand new evidence-based guideline for electrodiagnostic assessment of individuals with cervical SCI.*

Berger MJ, Adewuyi AA, Fox IK, Franz CK. Clinical electrodiagnostic evaluation for nerve transfer surgery in spinal cord injury: a new indication and clinical pearls. *J Neurophysiol.* 2022 Oct 1;128(4):847-853.

Dr. Andrea Bundon: *This study included interviews with Olympic and Paralympic athletes starting with the announcement that the Olympic and Paralympic Games in Tokyo would be postponed during the pandemic. It's interesting that while the pandemic was clearly a hugely stressful and disruptive experience for all athletes, when the postponement of the Games was first announced, the Paralympians reported feeling like 'all athletes were in the same boat' and really felt solidarity with their non-disabled peers. But as the pandemic progressed, they came to understand that the re-opening was not equitable and athletes with disabilities were not getting the same consideration. The sense of belonging changed to a sense of exclusion or alienation.*

Bundon A, Trainor LR, Bennett EV, Tremblay MI, Mannella S, & Crocker PR. (2022). From minding the gap to widening the gap: Paralympic athletes' experiences of wellbeing during the postponement of the Tokyo 2020 games. *Frontiers in Sports and Active Living,* 2022 August 26.

Dr. Jacquelyn Cragg: *This study found that males with spinal cord injury exhibit a significantly higher prevalence of heart disease, compared to females with spinal cord injury. Moreover, relative to able-bodied individuals, spinal cord injury amplifies sex-related differences in heart disease. Overall, this work will inform targeted cardiovascular prevention strategies, and may also inform a better understanding of cardiovascular disease progression in both able-bodied and individuals with spinal cord injury.*

Jia A, Kuramoto L, Warner FM, Liu L, Williams AM, Conklin A, West CR, Cragg JJ. Sex differences in heart disease prevalence among individuals with spinal cord injury: A population-based study. *J Spinal Cord Med*. 2023 Mar 28:1-7.

will inform targeted cardiovascular prevention strategies

Dr. Peter Cripton: *To prevent SCI in head first impacts we need to know the posture and muscle activation in the neck and this study was the first to collect this data in a human subject population.*

Al-Salehi L, Siegmund GP, Cripton PA. Cervical spine kinematics in unbraced and braced subjects during inverted freefalls. *Traffic Inj Prev*. 2022;23(sup1):S186–9.

Dr. Stacy Elliott: *Being included in the American Urology Association Update Series is a prestigious recognition: this is the premier guideline for practicing urologists and residents for the AUA and one of the first authored by a non-urologist due to my SCI sexual and fertility rehabilitation experience.*

Invited AUA Update series for American Urological Association on Sexual and Fertility Rehabilitation of the Spinal Cord Injured Male (January 2023) Elliott, SL and Flannigan, R.

Dr. David Granville: *This paper describes a novel therapeutic approach to treat pressure injuries, wounds that commonly arise in people with spinal cord injuries. The publication is the culmination of studies made possible through 5 ICORD Seed Grants awarded to our group in consecutive years from 2018 to 2021. Dr. Christopher Turner, a former Postdoctoral Fellow from our lab, had identified that a clinically-approved, off-patent antibiotic, sulfaphenazole, could promote the healing and alleviate the severity of pressure injuries. These findings provide strong rationale to pursue the repurposing of sulfaphenazole as a novel therapeutic for pressure injuries.*

SUPPORTED BY: Rick Hansen Foundation

Turner CT, Pawluk M, Bolsoni J, Zeglinski MR, Shen Y, Zhao H, Ponomarev T, Richardson KC, West CR, Papp A, Granville DJ. Sulfaphenazole reduces thermal and pressure injury severity through rapid restoration of tissue perfusion. Sci Rep. 2022 Jul 23;12(1):12622.

could promote the healing and alleviate the severity of pressure injuries

Dr. Veronica Hirsch-Reinshagen: *This paper introduces the International SCI Biobank to the worldwide traumatic SCI research community as a unique resource of human tSCI tissue for translational research.*

SUPPORTED BY: Rick Hansen Foundation

Hirsch-Reinshagen V, Velenosi A, Morris SR, Dong K, Samadi-Bahrami Z, Nassimbwa S, Abdelaziz E, Kozlowski P, Moore W, Laule C, Kwon BK. The International Spinal Cord Injury Biobank (ISCIB): A Biorepository and Resource for Translational Research. *J Neurotrauma.* 2022 Jul 26.

introduces the International SCI Biobank

Dr. Andrei Krassioukov: *This publication highlights female sexual function after SCI which is a hugely understudied and underprioritized area of SCI research and treatment. Sexual function in rated as the primary recovery target for quality of life after SCI.*

Shackleton C, Samejima S, Miller T, Sachdeva R, Parr A., Samadani U, Theoden N, Hocaloski S, Elliott S, Walter M, Darrow D, Krassioukov A. Effect of epidural spinal cord stimulation on female sexual function after spinal cord injury. *Frontiers in Neurosciences.* 2023;17: 155796.

Dr. Brian Kwon: *This is an exciting paper for us because it is the first time that we have demonstrated the utility of a blood-based biomarker for acute spinal cord injury. Previously, our efforts were largely concentrated on CSF. But the potential for proteins in the blood to serve as biomarkers of SCI makes this approach much more applicable broadly.*

Stukas S, Cooper J, Gill J, Fallah N, Skinnider MA, Belanger L, Ritchie L, Tsang A, Dong K, Streijger F, Street J, Paquette Frscs S, Ailon T, Dea N, Charest-Morin R, Fisher CG, Bailey CS, Dhall S, Mac-Thiong JM, Wilson JR, Christie S, Dvorak MF, Wellington CL, Kwon BK. Association of CSF and Serum Neurofilament Light and Glial Fibrillary Acidic Protein, Injury Severity, and Outcome in Spinal Cord Injury. *Neurology.* 2023 Jan 4:10.1212/

demonstrated the utility of a blood-based biomarker for acute SCI

Dr. Tania Lam: *This paper was the result of Maya Sato-Klemm's undergraduate directed studies project with us, and the first time we conducted survey-based research. In this work, we heard directly from respondents with SCI, importantly about their attitudes*

and perceptions about the pelvic floor and the potential role of these muscles in recovery of urogenital function. We also noted some clear sex differences in people's perceptions about the role of the pelvic floor in urogenital health in that males tended to report being less knowledgeable and less likely to believe that they could benefit from PFM. Considering the typical demographics of the SCI population, this poses interesting challenges for future research in this area.

Sato-Klemm M, Williams AMM, Mortenson WB, Lam T. Knowledge, attitudes, and practice of pelvic floor muscle training in people with spinal cord injury: a cross-sectional survey. *Frontiers in Rehabilitation Sciences*, section Interventions for Rehabilitation. 3: 893038, 2022.

Dr. Cornelia Laule: *This study looks at how MRI metrics in white matter fiber tracts may, or may not, vary according to how the position of the white matter tract is in relation to the direction of the MRI scanner magnetic field. The work provides evidence that challenges a controversial hypothesis in the literature about proposed magnetic field orientation dependence of myelin water imaging in brain white matter structures.*

Morris SR, Vavasour IM, Smolina A, MacMillan EL, Gilbert G, Lam M, Kozlowski P, Michal C, Manning A, Mackay AL, Laule C. Myelin biomarkers in the healthy adult brain: correlation, tract orientation effects and reproducibility. *Magnetic Resonance in Medicine.* 2023;89(5):1809-1824

provides evidence that challenges a controversial hypothesis

Kathleen Martin Ginis: *We developed a very cool methodology for tracking changes over time in the number and types of barriers people with SCI experience when they are trying to adopt a new exercise routine. Not only are these data descriptively interesting, but they provide evidence that a behavioural counseling program is working, and they provide direction for developing targeted strategies to support exercise behaviour change in adults with SCI.*

Dinwoodie M, Hoekstra F, Stelzer S, Ma J, & Martin Ginis KA. (2022). Dynamic analysis of physical activity barriers experienced by adults with spinal cord injury. *Spinal Cord Series and Cases*, 8, 37.

Dr. Ben Mortenson: *This seed grant-funded study was proposed by staff at SCI-BC and we did it in collaboration with them. It focussed on an often-overlooked population of people with SCI and the findings have important policy and practice implications.*

focussed on an often-overlooked population of people with SCI

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Jeawon M, Hase B, Miller S, Eng JJ, Bundon A, Chaudhury H, Maffin J, Clarkson R, Wright J, Mortenson WB. Understanding the experiences, needs, and strengths of people with incomplete spinal cord injury who can ambulate. *Disabil Rehabil.* 2023 Feb 5:1-10.

Dr. Tom Oxland: *This is a proof of principle that a particular type of MRI scanning could provide insight on the activity of skeletal muscles, which could have wide-ranging implications, including for SCI patients.*

Shaikh N, Yung A, Zhang H, Street J, Laule C, Oxland T, Wilson DR. Muscle activity with 0.5 T upright MRI-DESS to measure T2 in biceps and triceps. *J Orthop Res.* 2023 Mar;41(3):698-704.

Dr. Babak Shadgan: *In this paper in a high-impact journal, we introduced a new noninvasive method for detecting cardiac arrest using near-infrared spectroscopy.*

Raschdorf K, Mohseni A, Hogle K, Cheung A, Manouchehri N, So K, Khalili M, Lingawi S, Grunau B, Kuo C, Christenson J, Shadgan B. Evaluation of transcutaneous near-infrared spectroscopy for early detection of cardiac arrest in an animal model. Scientific Reports, 13, 4537 (2023).

Dr. Cheryl Wellington: *This paper describes the most extensive examination of blood biomarkers in SCI and set the stage for a major DoD-funded multisite validation study currently underway.*

Stukas S, Cooper J, Gill J, Fallah N, Skinnider MA, Belanger L, Ritchie L, Tsang A, Dong K, Streijger F, Street J, Paquette S, Ailon T, Dea N, Charest-Morin R, Fisher CG, Bailey CS, Dhall S, Mac-Thiong JM, Wilson JR, Christie S, Dvorak MF, Wellington CL, Kwon BK. Association of CSF and Serum Neurofilament Light and Glial Fibrillary Acidic Protein, Injury Severity, and Outcome in Spinal Cord Injury. *Neurology.* 2023 Mar 21;100(12):e1221-e1233.

Dr. Chris West: *This translational (rodent and human) paper presents data from 6 years of work in my lab and comprehensively demonstrates the mechanism responsible for cardiac dysfunction following spinal cord injury. This work provides the backdrop for all of the currently funded projects that examine novel methods to augment cardiovascular function in the field of spinal cord injury.*

Fossey MPM, Balthazaar SJT, Squair JW, Williams AM, Poormasjedi-Meibod MS, Nightingale TE, Erskine E, Hayes B, Ahmadian M, Jackson GS, Hunter DV, Currie KD, Tsang TSM, Walter M, Little JP, Ramer MS, Krassioukov AV, West CR (2022). Spinal cord injury impairs cardiac function due to impaired bulbospinal sympathetic control. *Nat Commun.* 16;13(1):1382.

comprehensively demonstrates the mechanism responsible for cardiac dysfunction following SCI

Dr. Stephanie Willerth: *This paper features our spinal cord phantoms from the Mend the Gap project.*

Karaman D, Willerth SM. Utilizing additive manufacturing to produce organ mimics and imaging phantoms. *Surgeries*. 2003. 4. 58–72.

Dr. David Wilson: *This is a topical area and it emphasizes the importance of muscle function in spine biomechanics. It also represents a productive collaboration with several other ICORD members and students.*

Malakoutian M, Noonan AM, Dehghan-Hamani I, Yamamoto S, Fels S, Wilson D, Doroudi M, Schutz P, Lewis S, Ailon T, Street J, Brown S, Oxland TR. Dysfunctional paraspinal muscles in adult spinal deformity patients lead to increased spinal loading. *European Spine Journal* 2022:31 (9), 2383-2398.

See *Appendix 1: Selected Publications by ICORD Principal Investigators* for more publication information.

Above: ICORD trainees, staff, and faculty photographed at the ARM; below: Dr. Brett Hilton.

People

New Researchers:

In collaboration with the Department of Cellular and Physiological Sciences, ICORD was able to hire **Dr. Brett Hilton** as a new faculty member to join ICORD as a Principal Investigator. Dr. Hilton's appointment as assistant professor was supported with $400,000 in lab start-up funds from RHF. With a diverse background in neuroscience research, Dr. Hilton completed a PhD at UBC in Dr. Wolfram Tetzlaff's lab before his postdoctoral research in the lab of Professor Frank Bradke at the Germany Center for Neurodegenerative Diseases. The Hilton Lab's principal research goal is to understand why nerve cells fail to regenerate their axons following spinal cord injury. Dr. Hilton is interested in discovering the fundamental cellular and molecular processes that prevent regeneration and finding clinically relevant ways of targeting these processes in a way that promotes regeneration.

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Drs. Karen Cheung, John Madden, and **Jasmin Ma** joined ICORD as **Investigators** in 2022-2023 and **Drs. Judy Illes** and **Megan MacGillivray** joined as **Associate Members.**

Drs. Cheung and Madden are both Professors in the Department of Electrical and Computer Engineering at UBC and principal investigators on the Mend the Gap project collaborating with several ICORD PIs. Dr. Cheung's research interests include biomedical microsystems for diagnostic and therapeutic applications, dielectric spectroscopy for flow cytometry, implantable polymer-based microelectrode arrays, and integrated cell culture systems. Dr. Madden's research looks at artificial muscle and application to medical devices, photosynthetic photovoltaics, super-capacitors, batteries, sensors, and carbon nanotube devices.

Dr. Ma is an Assistant Professor of Teaching in the School of Kinesiology at UBC. She teaches and provides training in the areas of exercise prescription, physical activity behaviour change, and disability. Dr. Ma is leading the Work Integrated Learning program at PARC.

UBC professor of Neurology and Director of Neuroethics Canada, Dr. Judy Illes collaborates with several ICORD PIs, most recently on the Mend the Gap project. Dr. Megan McGillivray is an assistant professor at St. Francis Xavier University and collaborates on research with Drs. Bonnie Sawatzky and Ben Mortenson.

Dr. Bonnie Sawatzky moved from PI to Associate Member following her appointment as Director of Equity, Diversity and Inclusion for Orthopaedics

Awards to faculty

- Dr. Dena Shahriari was named a 2022 Michael Smith Health Research BC Scholar.
- Dr. Mike Berger received a Health Professions Investigator Award from Michael Smith Health Research BC
- Drs. Cornelia Laule and Cheryl Wellington received UBC Faculty of Medicine Distinguished Achievement Awards, Dr. Laule for overall excellence, mid-career, and Dr. Wellington for excellence in clinical or applied research
- Dr. Kathleen Martin Ginis was elected as a Fellow of the Canadian Academy of Health Sciences, one of the highest honours for individuals in the community.
- Dr. Victoria Claydon was one of Simon Fraser University's *Top 22 of 2022* in recognition of research contributions
- Dr. Brian Kwon was named a Fellow of ASIA, in recognition of longstanding dedication to, and distinguished accomplishments within, the fields of SCI research, clinical practice, education, and/or advocacy.
- Dr. Ben Mortenson was inducted as a Fellow opf the Canadian Association of Occupational Therapists
- Dr. Lyndia Wu received the UBC Mechanical Engineering Junior Faculty Teaching Award

Awards to Students

- Nicole Bailey (Kramer Lab) and Xueqing Zhou (Lam Lab) won 2022 VCHRI Rising Star awards
- Amanda Cheung (Kwon Lab) was 2022 VCHRI top graduating student
- Loay Al Salehi (Orthopaedic and Injury Biomechanics Lab) & Todd Kamensek (Oruc Lab) won 2022 Killam Graduate Teaching awards
- Dr. Rhyann McKay (Gainforth Lab) was 2022 UBC-Okanagan Student Researcher of the Year
- Dr. Oliver Wearing (West Lab) received a 2022 Killam Postdoctoral Fellow Award
- Dr. Tiev Miller(Krassioukov Lab) received a 2022 Michael Smith Health Research BC Trainee award
- Drs. Raza Malik (Krassioukov Lab) and Bethany Kondiles (Tetzlaff Lab) received Paralyzed Veterans of America Postdoctoral Fellowships

Awards to staff

- Former ICORD Managing Director Dr. Lowell McPhail and former Tetzlaff Lab Manager Nicole Janzen won ICORD Lifetime Achievement Awards in recognition of their many years of dedicated service.
- ICORD Facilities Manager Yuan Jiang and Kwon Lab Research Manager Dr. Femke Streijger won Vancouver Coastal Health Research Institute (VCHRI) Research Excellence Staff Awards. This competition acknowledges staff members with ten or more years of service who have demonstrated research excellence through mentorship, building research culture and upholding the VCHRI values of integrity, accountability, collaboration, equity and community- and patient-focus.

ICORD's Principal Investigators

Researchers whose primary research programs are closely aligned with the mission of ICORD

Dr. Michael Berger | Clinical Assistant Professor, Physical Medicine and Rehabilitation | UBC

Dr. Jaimie Borisoff | Adjunct Professor, former Canada Research Chair in Rehabilitation Engineering Design, Applied Research | BCIT / UBC

Dr. Andrea Bundon | Assistant Professor, Kinesiology | UBC

Dr. Victoria Claydon | Professor, Biomedical Physiology and Kinesiology | SFU

Dr. Jacquelyn Cragg | Assistant Professor, Pharmaceutical Sciences | UBC

Dr. Peter Cripton | Professor and Director pro tem - School of Biomedical Engineering, Co-Director - Orthopaedic and Injury Biomechanics Group, Mechanical Engineering / School of Biomedical Engineering / Orthopaedics | UBC

Dr. Marcel Dvorak | Cordula and Gunter Paetzold Chair in Spinal Cord Clinical Research | Orthopaedic Spine Surgeon, Professor, Orthpaedics (Spine), Division of Spine, Orthopaedics | UBC / VCHRI / VCH

Dr. Stacy Elliott | Clinical Professor; Medical Director, BC Centre for Sexual Medicine and Medical Consultant to Sexual Health Rehabilitation Services, VCH; Co-Director Vancouver Sperm Retrieval Clinic, Sexual Health Lead, Prostate Supportive Care Program, Prostate Centre, Psychiatry; Urologic Sciences | UBC / VCHRI / VCH

Dr. Janice Eng | Professor, Physical Therapy, Canada Research Chair in Neurological Rehabilitation | UBC / GF Strong

Dr. Susan Forwell | Professor and Head, Occupational Science and Occupational Therapy; Research Associate, Neurolgy, Faculty of Medicine | UBC / VCH

Dr. Heather Gainforth | Associate Professor, School of Health and Exercise Sciences | UBCO

Dr. David Granville | Professor, Pathology and Laboratory Medicine | UBC

Dr. Brett Hilton | Assistant Professor, Cellular and Physiological Sciences | UBC

Dr. Veronica Hirsch-Reinshagen | Assistant Professor, Pathology and Laboratory Medicine | UBC

Dr. Piotr Kozlowski | Professor; Director, Magnetic Resonance Imaging Research Centre; Research Scientist, Radiology; Urologic Sciences | UBC

Dr. John Kramer | ICORD Associate Director, Pre-clinical Research; Associate Professor, Anasthesiology, Pharmacology, and Therapeutics | UBC

Dr. Andrei Krassioukov | Patrick Reid Chair in Spinal Cord Rehabilitation Research; ICORD Associate Director, Rehabilitation Research; Professor, Medicine | ICORD/UBC

Our Vision:

Make spinal cord injury preventable, livable, & curable.

Our Mission:

Conduct research and training towards the development and translation of more effective strategies to promote prevention, functional recovery, and improved quality of life after spinal cord injury.

Dr. Brian Kwon | ICORD Associate Director, Clinical Research; Professor/Canada Research Chair/ Spine Surgeon/ Research/Director Spine Research Program, Orthopaedics, Medicine | UBC / VCH

Dr. Tania Lam | Professor, Kinesiology | UBC

Dr. Cornelia Laule | ICORD Associate Director, Education and Training; Associate Professor, Radiology; Pathology and Laboratory Medicine; Physics & Astronomy | UBC

Dr. Kathleen Martin Ginis | Professor, Department of Medicine; School of Health and Exercise Sciences; / Director, SCI Action Canada; Director, Centre for Chronic Disease Prevention and Management | UBC-O

Dr. Bill Miller | Professor, Associate Dean - Health Professions, Medicine | UBC

Dr. Wayne Moore | Clinical Professor, Pathology and Laboratory Medicine | UBC

Dr. Ben Mortenson | Associate Professor, Occupational Science and Occupational Therapy | UBC, SFU

Dr. Mark Nigro | Clinical Professor, Urologic Sciences | UBC / VCH

Dr. Ipek Oruc | Associate Professor, Opthalmology | UBC

Dr. Tom Oxland | Professor, Orthopaedics; Mechanical Engineering | UBC

Dr. Matt Ramer | Lyall Knott BC Neurotrauma Professor; Associate Professor, Zoology; Neurosurgery | UBC

Dr. Babak Shadgan | Assistant Professor, Orthopaedics | UBC / VCH

Dr. Dena Shahriari | Assistant Professor, Orthopaedics; School of Biomedical Engineering | UBC / VCH

Dr. Lynn Stothers | Professor, Urologic Sciences | UBC / VCH

Dr. Wolfram Tetzlaff | John and Penny Ryan BC Leadership Chair in Spinal Cord Research | Professor and Director of ICORD, Zoology; Surgery | UBC

Dr. Darren Warburton | Professor, Kinesiology; Experimental Medicine | UBC

Dr. Cheryl Wellington | Professor, Pathology and Laboratory Medicine | UBC

Dr. Chris West | Associate Professor, Cellular and Physiological Sciences | UBC

Dr. Stephanie Willerth | Canada Research Chair in Biomechanical Engineering; Professor, Mechanical Engineering and Medical Science | UVic

Dr. David Wilson | Professor, Orthopaedics | UBC

Dr. Lyndia Wu | Assistant Professor, Mechanical Engineering | UBC

ICORD
Annual Report
2022-23

Investigators

Researchers whose primary research programs are peripherally aligned with the mission of ICORD

Dr. Phil Ainslie, Centre for Heart, Lung & Vascular Health, UBC
Dr. Mohsen Akbari, Mechanical Engineering, UVic
Dr. Hugh Anton, Physical Medicine & Rehabilitation, UBC/ VCH
Dr. Gary Birch, Neil Squire Society
Dr. Sean Bristol, Surgery, UBC
Dr. Erin Brown, Plastic Surgery, UBC/VCH
Dr. Mark Carpenter, Kinesiology, UBC
Dr. Karen Cheung, Electrical and Computer Engineering, UBC
Dr. Anita Delongis, Psychology, UBC
Dr. Christopher Doherty, VCH
Dr. Kayla Fewster, Kinesiology, UBC
Dr. Josh Giles, Mechanical Engineering, UVic
Dr. Tal Jarus, Occupational Science & Occupational Therapy, UBC
Dr. Shannon Kolind, Neurology, UBC
Dr. Jasmin Ma, Kinesiology, UBC
Dr. John Madden, Electrical and Computer Engineering, UBC
Dr. Tim O'Connor, Kinesiology, UBC
Dr. Scott Paquette, Surgery, UBC/VCH
Dr. Jacqueline Quandt, Pathology and Laboratory Medicine, UBC
Dr. Jane Roskams, Zoology, UBC
Dr. Mypinder Sekhon, Critical Care Medicine, UBC/VCH
Dr. Bill Sheel, Kinesiology, UBC
Dr. Carolyn Sparrey, Mechatronics System Engineering, SFU
Dr. John Street, Orthopaedics, UBC/VCH
Dr. Andrea Townson, Physical Medicine and Rehabilitation, UBC/ VCH

Associate Members

Researchers who collaborate with ICORD PIs

Dr. Tim Bhatnagar, BCCHR
Dr. Mike Boyd, VCH
Dr. Romeo Chua, UBC
Dr. Jens Coorsen, U Western Sydney
Dr. Kerry Delaney, UVic
Dr. Andy Hoffer, SFU
Dr. Judy Illes, UBC
Dr. Tim Inglis, UBC
Dr. Megan McGillivray, St. Francis Xavier U
Dr. Mohamed Javan, Tarbiat Modares U
Dr. Andrew Laing, U Waterloo
Dr. Nan Liu, Peking U
Dr. Freda Miller, UBC
Dr. Michael Negraeff, VCH
Dr. Tom Nightingale, U Birmingham
Dr. Aaron Phillips, U Calgary
Dr. Miriam Spering, UBC
Dr. Paul van Donkelaar, UBC
Dr. David Whitehurst, SFU
Dr. Rhonda Willms, VCH

Emeritus Members

Dr. Tom Grigliatti
Dr. Catherine Pallen
Dr. John Steeves (Founding Director)
Dr. E. Paul Zehr

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 2022-23 Annual Report.

Prepared by Cheryl Niamath. **Contributors:** Nancy Thorogood, Katie Ashwell, Yeram Ko, Martin Dee, Xueqing Zhou, Paul Lesack.

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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