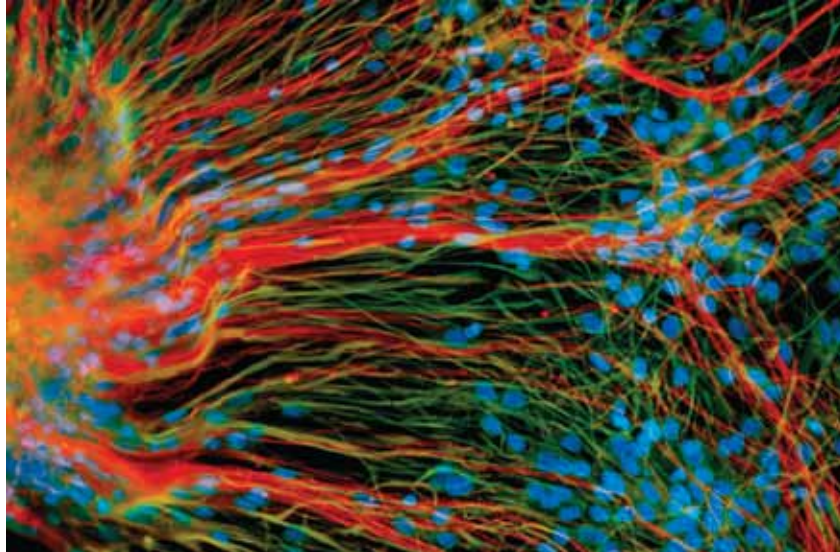


from cells to community

SPINAL CORD INJURY RESEARCH AT ICORD



UNIVERSITY OF BRITISH COLUMBIA + VANCOUVER COASTAL HEALTH + RICK HANSEN FOUNDATION



Sincere thanks to ICORD Researchers and the UBC Faculty of Medicine for their support of and assistance with the creation of this report.

Written by Ted Peterson, Lowell McPhail & Cheryl Niamath

Edited by Fraser Hannah, handwrought editing

Designed by Cheryl Niamath

Photo credits: see page 48

© 2011 ICORD (International Collaboration On Repair Discoveries)

All rights reserved. No part of this book may be reproduced or transmitted in any form by any means without permission in writing from the publisher.

ICORD

University of British Columbia & Vancouver Coastal Health Research Institute

3rd Floor, 818 West 10th Avenue

Vancouver, BC Canada V5Z 1M9

tel: 1-604-675-8800 • fax: 1-604-675-8820 • admin@icord.org

Printed in Canada by Friesens

ISBN: 978-0-9782959-4-3



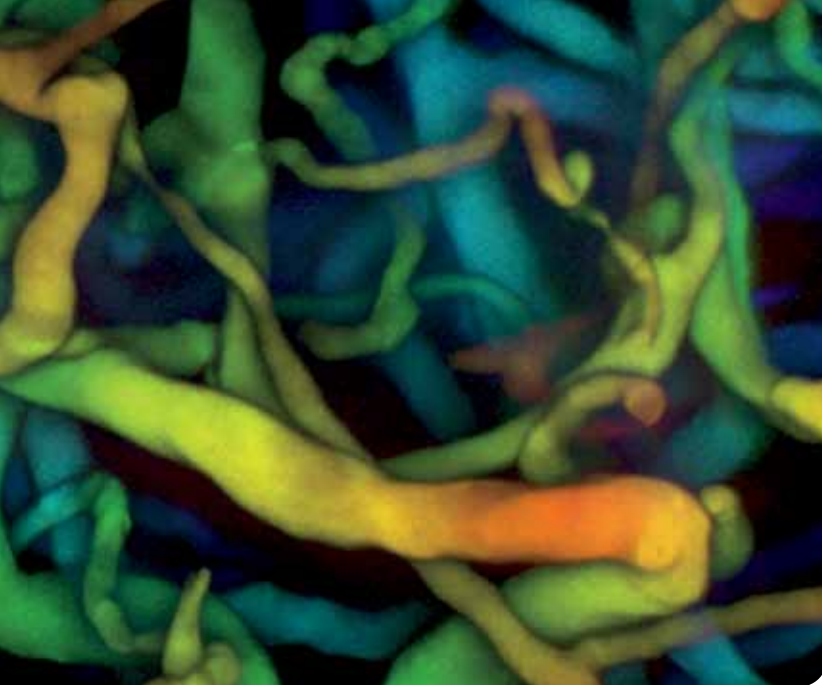
from cells to community:



SPINAL CORD INJURY RESEARCH AT ICORD

CONTENTS

welcome	4
introduction	5
milestones in ICORD's history	8
people	12
research	16
partners	34
looking back	40
looking forward	46
photo credits	48



“ICORD has come to exemplify the power of collaborative research. By bringing together UBC’s experts in basic sciences, engineering, clinical disciplines and rehabilitation, it has improved health outcomes—and everyday life—for people with spinal cord injuries, and continually instills hope that more improvements are coming our way. Universities are uniquely positioned to create this kind of alchemy, but it can’t be done without the kind of support we have received over the years from the Rick Hansen Foundation.”

- Professor Gavin Stuart
DEAN, UBC FACULTY OF MEDICINE

welcome



On behalf of my colleagues at ICORD, I am delighted to present this report *From Cells to Community: Spinal Cord Injury Research at ICORD*. It has certainly been a time of tremendous progress for ICORD, holding much promise for future advances towards finding a cure for spinal cord injury and improving the lives of people with SCI.

In this report can be found descriptions of research that has already made a difference in the lives of people with SCI, including

advanced surgical strategies for stabilizing the injured spinal column, and the identification of best practices for the rehabilitation of people with SCI. ICORD is also looking to the future, with exciting research such as a device to prevent future spinal injuries, innovative cell-therapy strategies aiming to heal the damaged spinal cord, and novel approaches for enhanced rehabilitation and community integration.

Now that we are located in the Blusson Spinal Cord Centre at Vancouver General Hospital along with the Brenda and David McLean Integrated Spine Clinic and the Rick Hansen Institute, we have tremendous opportunity to create a truly international centre of excellence that identifies, develops, and translates new approaches to enhance the lives of people with SCI. Our ultimate success will be through collaboration within the BSCC, with key community organizations, and with other Canadian and international research centres.

I wish to thank the University of British Columbia, Vancouver Coastal Health, the Governments of British Columbia and Canada, and the Rick Hansen Foundation for their leadership and unwavering support of ICORD. We are very fortunate to have such strong partners.

- Thomas Oxland
ACTING DIRECTOR, ICORD

introduction

Hope: there is an overwhelming sense of it at ICORD. Every day it is seen in the tireless efforts of our staff, researchers, partners, and donors. There is an expectation of a better future here—the confidence that, together, we can tackle one of Canada’s major unsolved health care challenges: spinal cord injury (SCI).

Located in the Blusson Spinal Cord Centre at Vancouver General Hospital, we are a distinct academic health research centre working directly with people with SCI to create opportunities and enhance their quality of life. Beginning in 1995 as a research group in UBC’s Faculty of Science, ICORD (then known as CORD) was founded under the leadership of Dr. John Steeves with the vital support of Mr. Rick Hansen, C.C., O.B.C., and then-UBC President David Strangway. In 2002, we became ICORD after receiving funding to construct a new building from the Canada Foundation for Innovation. This important grant was matched by the BC Knowledge Development Fund, with additional funding for the project pledged by UBC, Vancouver Coastal Health, and the Rick Hansen Foundation. ICORD is supported by UBC Faculty of Medicine and Vancouver Coastal Health through its Research Institute (VCHRI).

Both accelerating the search for a cure for SCI and enhancing the quality of life for thousands of people with these injuries, ICORD is a unique initiative that brings together spinal cord injury researchers from the sciences, medicine, surgery, rehabilitation, engineering, education, and community-based humanities research. We currently have forty-one principal investigators, including five endowed chairs established through the generous support of the Rick Hansen Foundation. ICORD also plays a leadership role in several national and international initiatives, including a national Translational Research Network, a Spinal Cord Injury Registry, and the development of the world’s first guidelines for SCI clinical trials. From strategies to prevent SCI to the use of stem cells for neural regeneration, our investigators are committed to world-class research that makes a difference for people with spinal cord injury.

“UBC is proud of its leading research in spinal cord injury. Not only is this work integral to finding a cure for SCI, but it also plays an important role in advancing a collective understanding of these injuries. ICORD is a leader in striving to improve the quality of life for those with SCI through the discovery, dissemination, and application of research across disciplines.”

- Professor Stephen J. Toope,
PRESIDENT AND VICE-CHANCELLOR,
UNIVERSITY OF BRITISH COLUMBIA





If you had suffered a spinal cord injury before the twentieth century, your outlook would have been grim. Even if you had survived your initial injury, complications would likely have overwhelmed you.

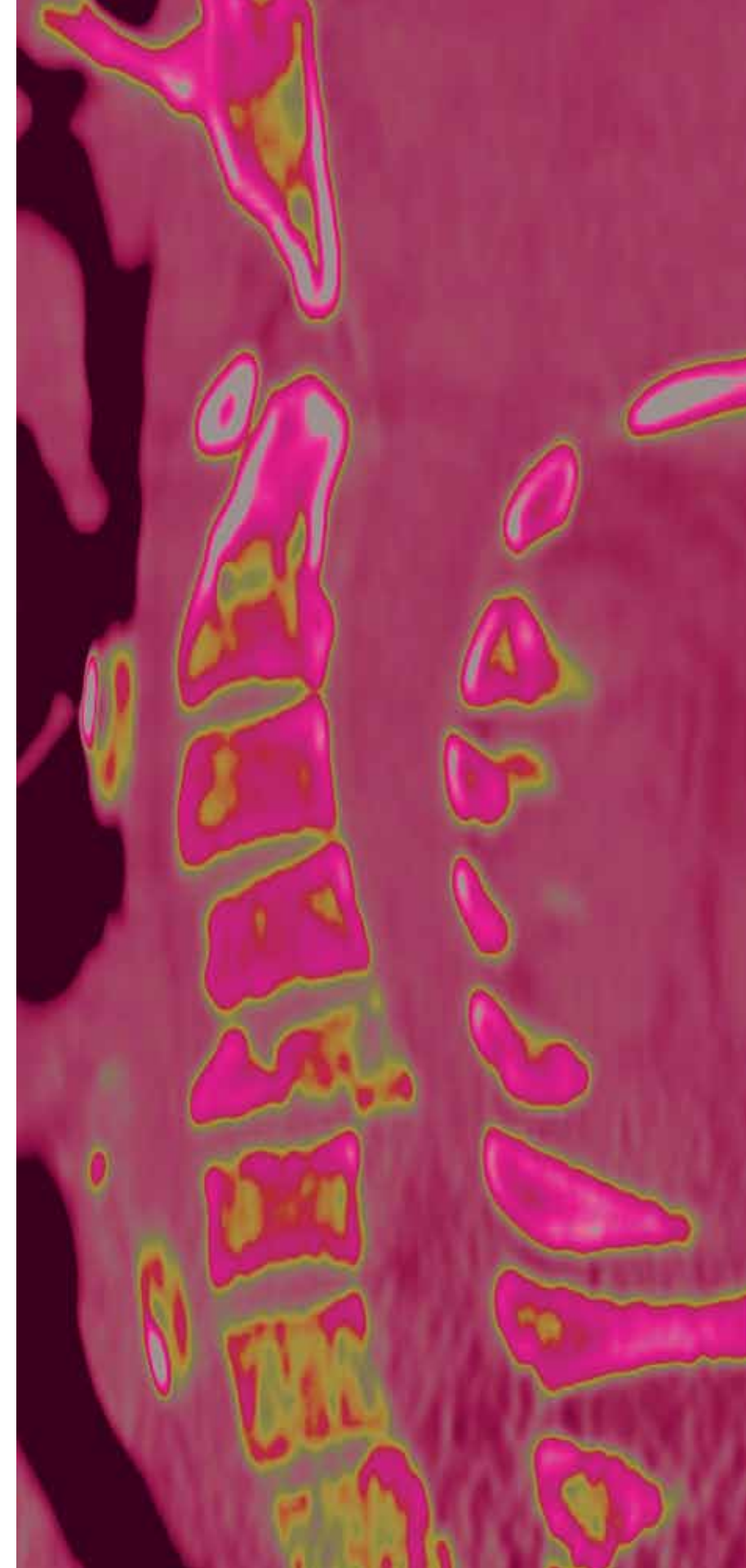
In the late 1980s, most likely you would have been treated with months of bed rest and traction, and would have been anticipating partial or complete paralysis and life in a world filled with new limitations.

Thanks to advances in spinal cord research, people arriving at the hospital after SCI now benefit from significant improvements in patient care. The combination of progressive drug therapies, advanced surgical techniques for stabilization of the spine, evidence-based physical therapy and rehabilitation, specialized outpatient care and enlightened community support provide a much more optimistic outcome for people injured today.

Spinal cord injury research at ICORD has been able to advance over the years for a number of reasons:

- seed funding in the early 2000s from the Rick Hansen Foundation allowed the incubation of novel interdisciplinary research projects and resulted in proposals that could be put forward for traditional grant competitions;
- the Blusson Spinal Cord Centre at VGH has become a hub of excellence in SCI research and care;
- increased collaboration among researchers has inspired new approaches to investigation;
- closer proximity to patients provides greater opportunities for clinical and rehabilitation research studies; and
- advances in technology have resulted in better tools and equipment for research, treatment and communication.

Generous support from our partners has allowed ICORD to grow from a small group of researchers in Vancouver investigating SCI to a respected interdisciplinary centre with productive connections around the world.



milestones in ICORD's history

Rick Hansen Man In Motion Chair in Spinal Cord Injury Research (\$1.5M) established with funding from Rick Hansen Foundation and UBC.

1993



Dr. Steeves (R) in the lab with trainee Dr. Gordon Hiebert (L).

1995

Collaboration On Repair Discoveries (CORD) is founded as a Research Group within the UBC Faculty of Science by **Dr. John Steeves** with the support of **Mr. Rick Hansen** and UBC President **Dr. David Strangway**.

1997

BC Neurotrauma Professorship (\$2M) and **Rick Hansen Institute Spinal Cord Research Endowment (\$1.5M)** established to fund CORD programs. Both endowments are funded by the Rick Hansen Foundation and UBC.

1999



Dr. Matthew Ramer is recruited as **BC Neurotrauma Professor**.

2001



Dr. Wolfram Tetzlaff is recruited as **Rick Hansen Man In Motion Spinal Cord Injury Chair**.

BC Neurotrauma Fund Contribution Act passed by British Columbia Legislature, whereby a percentage of income from traffic infractions is awarded annually to the **Rick Hansen Foundation** to support "services and projects respecting neurotraumatic injury and victims of neurotraumatic injury." With the BCNF funding, RHF establishes an annual grant competition funding SCI research.

Application to **Canada Foundation for Innovation (CFI) Infrastructure Grant** program for \$12.9M for **ICORD (International Collaboration On Repair Discoveries): an interdisciplinary research centre for the development of effective strategies to promote functional recovery after SCI**.



Original artist's rendition of the new research centre created for the CFI application

CFI Grant awarded; CORD becomes ICORD.

Rick Hansen Foundation partners with the **BC Government, UBC and Vancouver Coastal Health** to establish **three endowed Chairs**: BC Leadership Chair in Spinal Cord Injury Research (\$4.5M), Chair in Spinal Cord Rehabilitation Research (\$3M) & Cordula and Günter Paetzold Chair in Spinal Cord Clinical Research (\$3M).



The Community Advisory Panel's first meeting.

ICORD holds its first **Annual Research Meeting**. International and Community Advisory Panels are formed.

Dr. John Steeves appointed as first **BC Leadership Chair in SCI Research**.

Trainee Travel Supplement program starts with funding from **Rick Hansen Foundation**.

John & Penny Ryan host the first of three annual **Reserved** gala fundraisers in Whistler in support of the BC Leadership Chair.

Aaron Moser and Gordon Hiebert Trainee Travel Awards created. With a generous donation by the Aaron Moser Foundation and a contribution in memory of former ICORD trainee Gordon Hiebert, an endowment to fund trainee travel awards is established.



Dr. Gordon Hiebert



Aaron Moser

2002

2003

2004

Rick Hansen Foundation dedicates **\$1M** in BC Neurotrauma Funding for **ICORD seed grants**.

With innovation support and seed funding from the **Rick Hansen Foundation**, the **Rick Hansen Spinal Cord Injury Registry** established by **Dr. Marcel Dvorak** to collect comprehensive nation-wide SCI data for the purpose of improving SCI care and clinical outcomes, and promote, encourage and support the pursuit of excellence in SCI health care management.

John & Penny Ryan pledge **\$1.5M** to **BC Leadership Chair endowment**. Chair is renamed the **John & Penny Ryan BC Leadership Chair in SCI Research** in recognition of their contribution.



L-R: John Ryan, Penny Ryan, John Steeves + Rick Hansen in Whistler, BC



Dr. Armin Curt is recruited from Switzerland as **Chair in Spinal Cord Rehabilitation Research**.

SCI Clinical Trials Guidelines established. ICORD hosts a two-day symposium, with more than 100 participants from around the world, to examine the essential aspects of human SCI studies. A Working Group is formed to synthesize a set of guidelines for SCI clinical trials.



Spinal Cord Injury Rehabilitation Evidence (SCIRE) published.

A highly accessible source of information is used by health care professionals, clients and their families, funding agencies, policy-makers, and advocacy groups, SCIRE is a synthesis of the research regarding outcome measures and rehabilitation strategies, to improve the health of people living with SCI.



Construction starts on Blusson Spinal Cord Centre.



Official Groundbreaking Ceremony, November 7, 2006. L-R: Honorable Gordon Campbell (Premier of BC); Mrs. Marilyn Blusson; Mr. Rick Hansen; Dr. John Steeves; Dr. Stewart Blusson; Professor Stephen Toope (President & Vice Chancellor of UBC); Ms. Suzanne Corbiel (VP External Relations, Canda Foundation for Innovation); Ms. Ida Goodreau (President & CEO, Vancouver Coastal Health); Dr. Bernie Bressler (Executive Director, Vancouver Coastal Health Research Institute and Vice President Research of Vancouver Coastal Health).

Translational Research Network launched by RHF with funding from Health Canada. **Armin Curt** heads TRN Rehabilitation Working Group. [The TRN is now the **Rick Hansen Institute**.]

2005

World Health Organization invites ICORD to participate in development of **International Classification of Functioning (ICF) Core Sets for SCI**.



Dr. Marcel Dvorak accepts **Cordula & Günter Paetzold Chair in Spinal Cord Clinical Research**.



ICORD moves from the Faculty of Science to the **Faculty of Graduate Studies**.

2006

ICORD moves from the Faculty of Graduate Studies (FoGS) to the **College for Interdisciplinary Studies** when FoGS splits into two bodies.

Stewart & Marilyn Blusson donate \$10M to RHF: \$8.75M is directed towards the new building.

2007



Construction on Blusson Spinal Cord Centre progresses.



Blusson Spinal Cord Centre officially opens November 18, 2008.



VIPs visit. On March 21, 2010, Rick Hansen celebrated the 25th anniversary of the start of his world tour. Prime Minister Stephen Harper and BC Premier Gordon Campbell visited ICORD's research space in the Blusson Spinal Cord Centre as part of the celebratory events.



Pictured L-R: Dr. David Farrar (Provost & VP Academic, UBC); Dr. David Ostrow (CEO, Vancouver Coastal Health); Dr. Brian Kwon (ICORD PI & VCH Clinician); Mr. Colin Ewart (Rick Hansen Foundation); Premier Gordon Campbell; Prime Minister Stephen Harper; Ms. Anna Sammarco (ICORD research study participant); Mr. Rick Hansen; Mr. Daryl Rock (Board Chair, Rick Hansen Institute); Dr. Tania Lam (ICORD Associate Director & PI); Ms. Katie Pahl (ICORD Study Coordinator); Dr. Antoinette Domingo (ICORD Postdoctoral Fellow); Dr. Tom Oxland (ICORD Acting Director & PI); Dr. Wolfram Tetzlaff (ICORD Associate Director & PI); Mr. Lyall Knott (Board Chair, Rick Hansen Foundation).

2008

2009

2010



Dr. Gary Birch is awarded the **Order of Canada** for his work with the Neil Squire Society.

Construction of **Blusson Spinal Cord Centre** completed. ICORD groups start moving from UBC Point Grey campus in October.



Vancouver Coastal Health's **Brenda & David McLean Integrated Spine Clinic** opens on BSCC 2nd floor. The clinic is designed to provide out patients with access to many different spine specialists at one time.

ICORD moves from CFIS to **Faculty of Medicine**, reflecting a strong interprofessional focus across health disciplines for research and patient outcomes, and strong connections to Vancouver Coastal Health and Vancouver Coastal Health Research Institute.



FACULTY OF MEDICINE



Dr. Tom Oxland becomes **Acting Director of ICORD**. Dr. Oxland is a Professor in Orthopaedics and Mechanical Engineering. He is Co-Director of the Orthopedics and Injury Biomechanics Lab, and has been an ICORD Principal Investigator since 1998.



“I worked as a research coordinator with ICORD upon completion of my Master of Science degree. I enjoyed my time studying with Dr. Ramer and working with Dr. Krassioukov, and I met some wonderful colleagues along the way. I have also gained a valuable understanding of and appreciation for SCI research, which I draw upon daily in my current position with the Rick Hansen Institute.”

- Lesley Soril

PROJECT MANAGER, ACCESS TO CARE + TIMING (ACT)
RICK HANSEN INSTITUTE

people

ICORD's top-of-the-line equipment and state-of-the-art labs would be of little use without the research faculty and trainees who make use of them. These researchers, in turn, rely on support staff to keep their labs running smoothly and their research programs on track. All the while, administrative staff work behind the scenes, taking care of facilities, finances, communications and events on behalf of ICORD.

At the Blusson Spinal Cord Centre, ICORD personnel are fortunate to share space, not only with other research teams, but also with the Rick Hansen Institute and the Brenda and David McLean Integrated Spine Clinic of Vancouver Coastal Health, giving us the opportunity to interact, collaborate with, and learn from an immensely varied group of people with a tremendous array of expertise.

And sometimes we just have fun together in the Atrium.



ICORD researchers in 2010

Dr. Hubert Anton INVESTIGATOR • *Clinical Associate Professor, Physical Medicine & Rehabilitation, UBC.*

Dr. Gary Birch PRINCIPAL INVESTIGATOR • *Executive Director, Neil Squire Society; Adjunct Professor, Electrical & Computer Engineering, UBC.*

Dr. Paul Bishop PRINCIPAL INVESTIGATOR • *Clinical Associate Professor, Orthopaedics, Div. Spine, UBC & VCH.*

Dr. Jaimie Borisoff INVESTIGATOR • *Associate Senior Research Engineer, Neil Squire Society.*

Dr. Michael Boyd ASSOCIATE MEMBER • *Clinical Associate Professor, Orthopaedics, Div. Spine, UBC & VCH.*

Dr. Mark Carpenter INVESTIGATOR • *Associate Professor & Tier II Canada Research Chair, Human Kinetics, UBC.*

Dr. Romeo Chua ASSOCIATE MEMBER • *Professor, Human Kinetics, UBC.*

Dr. Victoria Claydon PRINCIPAL INVESTIGATOR • *Assistant Professor, Kinesiology, Simon Fraser University.*

Dr. Peter Crompton PRINCIPAL INVESTIGATOR • *Associate Professor, Mechanical Engineering, UBC.*

Dr. Kerry Delaney ASSOCIATE MEMBER • *Professor, Biology, University of Victoria*

Dr. Anita Delongis INVESTIGATOR • *Associate Professor, Psychology, UBC.*

Dr. Marcel Dvorak PRINCIPAL INVESTIGATOR • *Associate Director of ICORD. Professor, Orthopaedics, Div. Spine, UBC & VCH.*

Dr. Stacy Elliott PRINCIPAL INVESTIGATOR • *Clinical Professor, Psychiatry, UBC; Clinical Director, BC Centre for Sexual Medicine; Co-Director, Vancouver Sperm Retrieval Clinic; Sexual Medicine Consultant, GF Strong Rehab Centre, UBC & VCH.*

Dr. Janice Eng PRINCIPAL INVESTIGATOR • *Professor, Physical Therapy, UBC & VCH.*

Dr. Charles Fisher PRINCIPAL INVESTIGATOR • *Associate Professor, Orthopaedics, Div. Spine, UBC & VCH.*

Dr. Susan Forwell PRINCIPAL INVESTIGATOR • *Associate Professor, Occupational Science & Occupational Therapy, UBC*

Dr. Thomas Grigliatti PRINCIPAL INVESTIGATOR • *Professor, Zoology, UBC.*

Dr. Andy Hoffer PRINCIPAL INVESTIGATOR • *Professor, Kinesiology; Director, Neurokinesiology, SFU.*

Dr. Timothy Inglis ASSOCIATE MEMBER • *Professor, Human Kinetics, UBC.*

Dr. Tal Jarus INVESTIGATOR • *Professor & Head, Occupational Science & Occupational Therapy, UBC*

Dr. Piotr Kozlowski PRINCIPAL INVESTIGATOR • *Assistant Professor, Radiology and Urologic Sciences, UBC.*

Dr. Andrei Krassioukov PRINCIPAL INVESTIGATOR • *Associate Director of ICORD. Professor, Division of Physical Medicine and Rehabilitation, Department of Medicine, UBC & VCH.*

Dr. Brian Kwon PRINCIPAL INVESTIGATOR • *Associate Professor, Orthopaedics, Div. Spine, UBC & VCH.*

Dr. Tania Lam PRINCIPAL INVESTIGATOR • *Associate Director of ICORD. Assistant Professor, Human Kinetics, UBC.*

Dr. Bill Miller PRINCIPAL INVESTIGATOR • *Associate Professor, Occupational Science & Occupational Therapy, UBC.*

Dr. Wayne Moore PRINCIPAL INVESTIGATOR • *Clinical Professor, Pathology & Laboratory Medicine, UBC.*

Dr. Mike Negraeff ASSOCIATE MEMBER • *Clinical Associate Professor, Anesthesiology, Pharmacology & Therapeutics*

Dr. Mark Nigro PRINCIPAL INVESTIGATOR • *Clinical Professor, Urologic Science, UBC & VCH*

Dr. Tom Oxland PRINCIPAL INVESTIGATOR • *Acting Director, ICORD; Professor, Orthopaedics and Mechanical Engineering, UBC & VCHRI. Canada Research Chair in Biomedical Engineering.*

Dr. Scott Paquette PRINCIPAL INVESTIGATOR • *Clinical Assistant Professor, Orthopaedics, Div. Spine, UBC & VCH.*

Dr. Matt Ramer PRINCIPAL INVESTIGATOR • *Associate Professor, Zoology, UBC.*

Dr. Jane Roskams INVESTIGATOR • *Professor, Zoology, UBC.*

Dr. Bonnie Sawatzky PRINCIPAL INVESTIGATOR • *Associate Professor, Orthopaedics, UBC & VCH.*

Dr. William Sheel INVESTIGATOR • *Associate Professor, Human Kinetics, UBC.*

Dr. John Steeves PRINCIPAL INVESTIGATOR • *Founding Director of ICORD. Professor, Zoology, Surgery, UBC & VCH.*

Dr. Wolfram Tetzlaff PRINCIPAL INVESTIGATOR • *Associate Director of ICORD. Professor, Zoology, UBC.*

Dr. Andrea Townson INVESTIGATOR • *Clinical Associate Professor and Head, Physical Medicine & Rehabilitation, UBC; Medical Manager SCI Program, GF Strong Rehab Centre, VCH.*

Dr. Darren Warburton PRINCIPAL INVESTIGATOR Associate Professor, Human Kinetics, UBC.

Dr. Rhonda Willms ASSOCIATE MEMBER Clinical Instructor, Physical Medicine & Rehabilitation, UBC

Dr. David Wilson INVESTIGATOR Associate Professor, Orthopaedics, UBC.

Dr. E. Paul Zehr PRINCIPAL INVESTIGATOR Associate Professor & MSFHR Biomedical Research Scholar, Kinesiology and Neuroscience, University of Victoria.



“The environment created at ICORD has enabled me to pursue my curiosity across the scientific spectrum—first as a graduate student, studying spinal cord regeneration under John Steeves; then as a post-doctoral fellow, working with Gary Birch on brain-computer interfaces that could one day allow people with disabilities to control devices by mere thought, and now, as a BCIT Research Scientist leading my own team developing accessible technologies to expand the range of daily living activities and increase community participation for people with disabilities. My path from biology to engineering couldn’t have happened except at a place like this, where disciplinary boundaries are nowhere to be found, and everyone is working toward a common goal.”

- Dr. Jaimie Borisoff
ASSOCIATE SENIOR RESEARCH ENGINEER
NEIL SQUIRE SOCIETY



ICORD trainees

Over the years, hundreds of trainees have completed programs with ICORD researchers, as graduate students, as medical residents, post-doctoral research fellows, and as visiting international students. Today, many of these trainees are continuing their studies in SCI, researching for public or private institutions, teaching, or enjoying fulfilling careers in other fields. Wherever they have gone, they have taken with them a deeper understanding of the challenges faced every day by people with SCI.

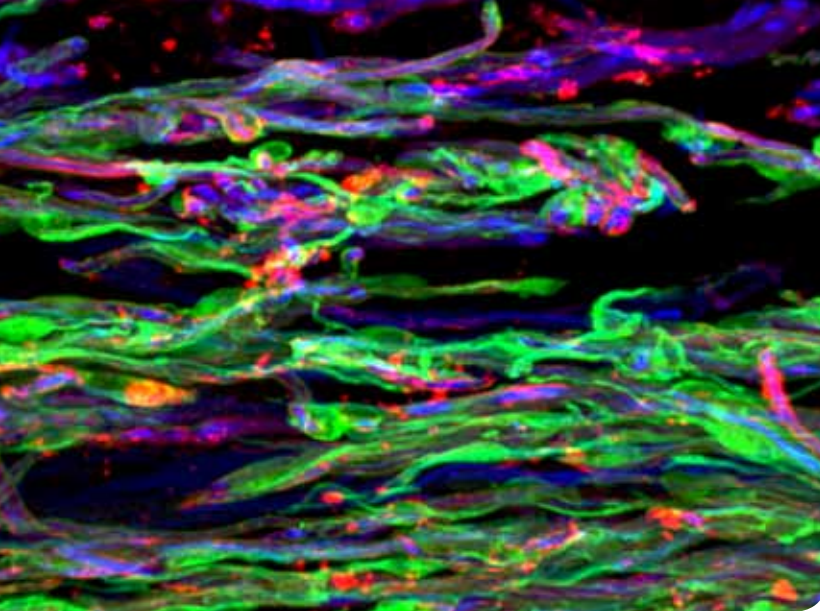
Trainees play a central role in ICORD’S research: organizing and running experiments, writing scientific papers to share their findings, and training and mentoring undergraduate students. ICORD trainees are supported by their supervisors’ operating grants, or by their own fellowships. Additionally, travel awards made available through grants from the Rick Hansen Foundation allow trainees to present their research nationally and internationally, and the annual Aaron Moser and Gordon Hiebert awards encourage excellence in trainee research.



ICORD staff

Support staff help keep ICORD moving forward. Whether administrative personnel paying invoices and organizing meetings, lab technicians helping with experiments, research associates designing projects, or clinical research staff working with patients and collecting data, each staff member is an important part of the research team.





research spotlights

At ICORD, we focus on two main research programs: discovering a cure for SCI and improving the quality of life for people with SCI. By focusing on a cure, we have a better understanding of spinal cord injuries and have developed novel approaches to repair the damage via neuroprotective and neuroregenerative strategies. In turn, our development of innovative interventions and assistive technologies will greatly help the day-to-day life of people with spinal cord injury.

As a research organization, we are uniquely positioned to generate knowledge through discovery research, and conduct clinical research to positively influence society. While discovery research allows us to continually fill the knowledge pipeline, clinical research can be applied to finding a cure and improving quality of life, including the evaluation of therapeutic and rehabilitation strategies.

Many advances have been made by ICORD researchers. Some have had a major impact on SCI research and care, while others have made small steps towards the larger goal. With sustainable funding for research programs, the pace of new discoveries can increase and lead to better translation of knowledge from the laboratory to the real world.

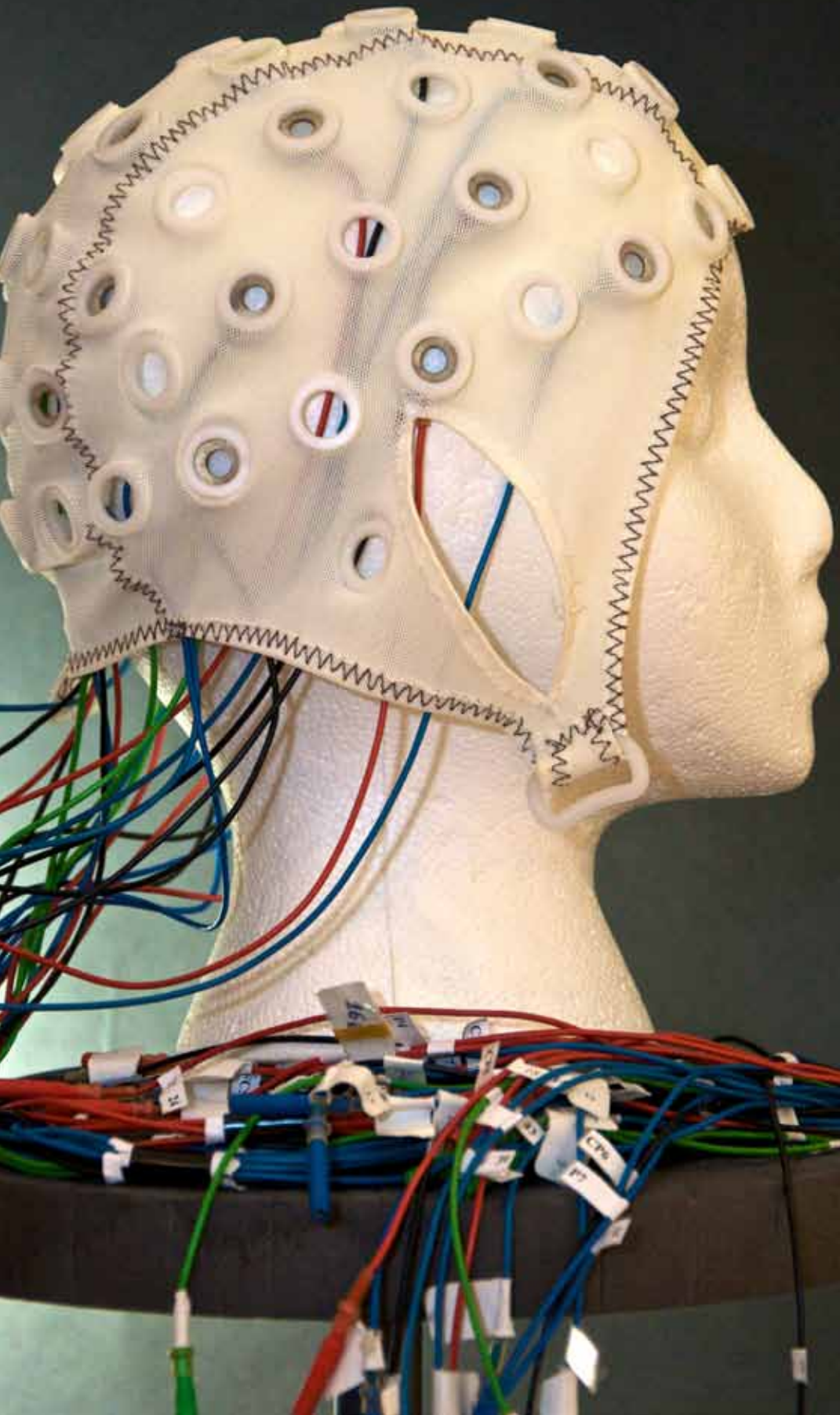
“We are proud to support and be a part of the work of ICORD. The ICORD model unites research with the needs of patients, and affords many opportunities to meet clinical needs as well as providing enhanced collaboration among all the partners in care, funding, and research.

We consider ICORD to be a leader in health research at Vancouver Coastal Health and far beyond.”

- Dr. Robert McMaster
EXECUTIVE DIRECTOR

VANCOUVER COASTAL HEALTH RESEARCH INSTITUTE





DR. GARY BIRCH

SENSORY SUBSTITUTION TECHNOLOGIES FOR SEXUAL REHABILITATION

An individual's sexual health is often severely impacted after SCI. Current research primarily addresses male erection and fertility; however, pleasure and orgasm are generally the top priorities for functional recovery. Dr. Birch's work in sensory substitution technologies transfers input from a lost sensory pathway to an intact pathway, a process known as "neuroplasticity". Dr. Birch works with **Dr. Stacy Elliott** and **Dr. Jaimie Borisoff**, and it was Dr. Borisoff who hypothesized that, through training, tongue sensations could be reinterpreted as the sensory perceptions from insensate genitalia, thus improving sexual experience for people with SCI. The results of this study are the first to show that sensory substitution is a possible approach to sexual rehabilitation.

BRAIN-COMPUTER INTERFACE

Dr. Birch's team has created a self-paced brain-computer interface (BCI) technology to improve the quality of life for people with severe motor impairment. The technology is based on EEG sensors to recognize intentional control, so that in the future people with SCI will be able to perform daily activities more comfortably.

DR. MARK CARPENTER

FINE-WIRE ELECTROMYOGRAPHY OF ABDOMINAL MUSCLES

Using a technique known as "electromyography" to provide the first recordings of deep and surface abdominal muscles, the research of Dr. Carpenter, Associate Professor of Human Kinetics at UBC, has brought many insights into how people with SCI use these muscles to help maintain their balance. Dr. Carpenter's findings have exciting implications for the development of new techniques for clinical assessments, as well as new physical training and rehabilitation strategies to improve balance.

DR. PETER CRIPTON

THE PRO-NECK-TOR HELMET

As Co-Director of the Orthopaedic and Injury Biomechanics Group, Dr. Crompton, with his laboratory team, is working toward the commercialization of a helmet that prevents injuries to the bones of the neck and the spinal cord during head-first impacts. The Pro-Neck-Tor helmet consists of a two-shell design which guides the head into a slight nodding motion upon head-first impact. This shift reduces the force on the neck bones during impact. Currently in the prototype stage, the Pro-Neck-Tor was awarded a "Best Of What's New" award in 2008 by *Popular Science* magazine.

DR. MARCEL DVORAK

THE RICK HANSEN SPINAL CORD INJURY REGISTRY

Dr. Dvorak started the Rick Hansen Spinal Cord Injury Registry (RHCSIR) in 2002 with seed funding from the Rick Hansen Foundation and ongoing funding and support from the Rick Hansen Institute. The RHSCIR tracks, stores and relates data about clinical treatments provided to people with SCI, with the mission to collect comprehensive nation-wide SCI data for the purpose of improving SCI care and clinical outcomes. Data in the registry can be used by researchers and clinicians to better understand the impact and effectiveness of specific medical interventions over the course of an individual's lifetime. The RHSCIR started locally, but there are now sites across Canada, with international sites to be established in the near future.

DR. STACY ELLIOTT

SEXUALITY AND REPRODUCTIVE HEALTH IN ADULTS WITH SPINAL CORD INJURY

After a spinal cord injury, people often have questions about relationships, their attractiveness, and their ability to conceive or bear children. In 2010, Dr. Elliott and a team sponsored by Paralyzed Veterans of America produced *Sexuality and Reproductive Health in Adults with Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals*, which addresses a wide range of topics related to sexuality, including the importance of privacy and individuality as well as the practical needs of people with SCI and their partners. The availability of this guideline will help ensure that an increasing number of knowledgeable professionals are available to support people reclaiming their sexuality after injury. Dr. Elliot, **Dr. Andrei Krassioukov**, and their team have also produced a further manual on sexual assistive devices for persons with disability. *PleasureABLE: Sexual Device Manual for Persons with Disabilities* can be downloaded from www.dhrn.ca/229 at no charge.

DR. JANICE ENG

SPINAL CORD INJURY REHABILITATION EVIDENCE (SCIRE)

Given the enormous cost of treatments for SCI, and its long-term consequences, the need for a rehabilitation program based on evidence has never been greater. Despite increasing amounts of rehabilitation research directed towards improving the lives of people with SCI, the implementation of health research knowledge as practice often takes more than a decade. SCIRE (www.scireproject.com) is a synthesis of the research regarding outcome measures and rehabilitation strategies to improve the health of people living with SCI. Principal Investigators Dr. Janice Eng, **Dr. Bill Miller**, and **Dr. Andrea Townson** have created a highly accessible source of information that is used by health care professionals, clients and their families, funding agencies, policy-makers, and advocacy groups.

DR. THOMAS GRIGLIATTI

PROTEOMICS

After an initial SCI, it is common for secondary damage to occur. Dr. Grigliatti is part of a team focusing upon defining the events associated with this secondary damage, and is currently identifying a suite of proteins that will allow the extent of SCI to be diagnosed. These studies, known as "proteomics" for the study of proteins, may soon identify the pathways that lead to secondary damage, recovery, and repair, to assist in developing therapeutic drugs and treatments for SCI. Dr. Grigliatti's proteomics work was recently recognized by the Faculty of 1000, an award-winning service highlighting and evaluating the most interesting papers published in the biomedical sciences, based on the recommendations of more than 2000 of the world's top researchers.



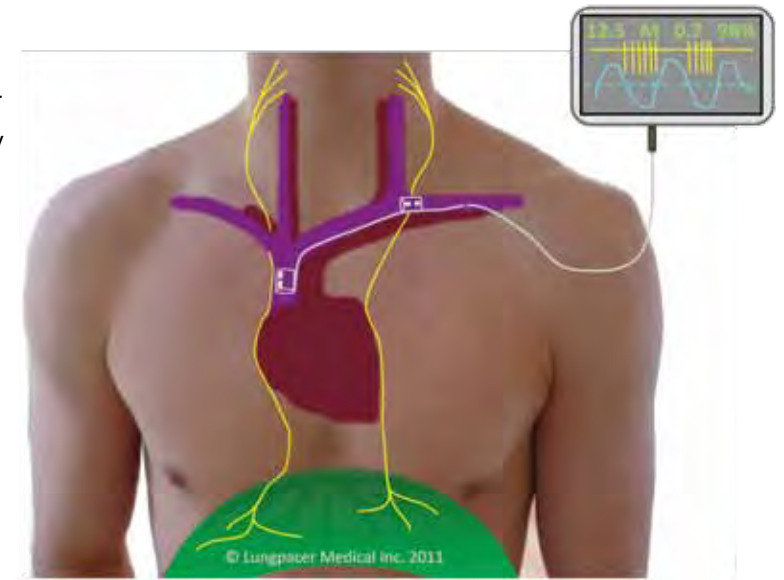
DR. ANDY HOFFER

THE NEUROSTEP®

First tested at Vancouver General Hospital in 2003, the Neurostep®, created by Dr. Hoffer and his Simon Fraser University spin-off company Neurostream Technologies, is surgically implanted in the thigh to assist walking in people who have paralysis and so-called foot-drop. The device includes electrodes to sense peripheral nerve activity from a patient's stance, and uses this information to activate the muscles lifting the foot. The Neurostep® can assist people with incomplete SCI, and to date is the only fully-implanted pacemaker-like system for walking.

THE LUNGPACER™

Currently in development by Dr. Hoffer and his SFU spin-off company Lungpacer Medical, the Lungpacer™ System offers a novel solution to assist breathing in critically ill patients, including those who have recently suffered a high level SCI. Lungpacer electrodes are designed for temporary insertion into a patient's vein in order to rhythmically activate the diaphragm muscle and keep it from weakening through disuse. This therapy is expected to help wean patients from mechanical ventilators and to result in a shorter stay for the patient in intensive care, fewer complications, faster overall recovery and lower hospitalization costs.



DR. ANDREI KRASSIOUKOV

INTERNATIONAL GUIDELINES FOR AUTONOMIC ASSESSMENT OF INDIVIDUALS WITH SCI

Dr. Krassioukov's research is aimed at assessing, understanding, and treating autonomic dysfunction following SCI. Malfunction of the body's automatic control of the cardiovascular system currently represents the leading cause of morbidity and mortality in people with SCI. One of the most important contributions to this area has been the development of guidelines for evaluating autonomic dysfunctions following SCI. For the past several years, as Chair of the International Committee of the American Spinal Injury Association and International Spinal Cord Society, Dr. Krassioukov has led an international effort in development of guidelines for autonomic assessment in individuals with SCI. These guidelines allow a novel, proactive approach to the assessment and early management of autonomic dysfunctions. Furthermore, the work of the committee encourages clinicians and scientists to include autonomic outcomes into clinical trials evaluating new therapies in individuals with SCI.

PARALYMPIC CLASSIFICATION AND VANCOUVER 2010 PARALYMPIC GAMES

Dr. Krassioukov's laboratory work on cardiovascular control following SCI attracted the attention of the International Paralympic Committee (IPC). His research team was involved in the evaluation of Paralympians at the 2008 Summer and 2010 Winter Paralympic Games. During the 2010 Winter Paralympic Games, his team, with a support from the IPC and the Craig H. Neilsen Foundation, held a Cardiovascular Health Clinic focused on education and research of unstable blood pressure control among Paralympic athletes, and the issue of "boosting" in wheelchair sport. Boosting is a controversial and dangerous practice in which wheelchair athletes deliberately cause themselves a mild injury, resulting in enhanced performance due to an increase in blood pressure. Beyond the



data collected, one of the most important accomplishments of this project was educating both the public and wheelchair athletes about the issues surrounding this practice.

BLOOD VESSELS, VISCERAL FAT AND CARDIOVASCULAR DISEASE IN SCI

In addition to human based research, Dr. Krassioukov has a large component of his work dedicated to basic laboratory science in the area of autonomic dysfunctions and SCI, allowing him to investigate many issues that he sees as clinician by modelling them in his laboratory. For example, injury-induced changes in many different parts of the nervous system may contribute to autonomic dysfunction; however, SCI has been found to affect all of the organ systems in the body. Dr. Krassioukov's laboratory, in collaboration with **Dr. Piotr Kozlowski** at the UBC/VCH MRI Research Centre, has found that SCI induces the accumulation of fat surrounding the organs, which is associated with cardiovascular disease. In addition, Dr. Krassioukov is working with **Dr. Ismail Laher** in the UBC Department of Anesthesiology, Pharmacology & Therapeutics to determine how blood vessels respond to SCI. The group has found that blood vessels may be adversely affected by the abnormal blood pressure fluctuations that occur following SCI. This research is supported by the Heart and Stroke Foundation.

DR. BRIAN KWON

CEREBRO-SPINAL FLUID PRESSURE

Through his clinical trial in acute spinal cord injured patients at Vancouver General Hospital, Dr. Kwon has discovered that cerebro-spinal fluid (CSF) can change dramatically after injury leading to periods of ischemia (a decrease in blood supply). Dr. Kwon is the first to describe the pattern through which inflammatory cytokines are expressed in human SCI, and has identified a series of proteins, known as "biomarkers", which can be used as identifiers of injury severity. These studies have led to the launch of a nation-wide study to evaluate CSF pressure and biomarkers.





DR. TANIA LAM

LOKOMAT: A ROBOTIC GAIT TRAINER

Dr. Lam's research aims to further our understanding of how the nervous system controls walking in order to develop better strategies for helping people with SCI improve their ability to walk. A primary tool that she uses in her research is the Lokomat, a robotic device used to help people whose ability to walk has been impaired by SCI. In a Lokomat, a person in a harness is suspended over a treadmill and a robot is attached to the outside of the person's legs. The robot's legs are controlled by specialized computer software that can provide different levels and types of assistance to the individual's leg movements. The computer can also control the pace of walking, and measure the individual's progress. In the past, most therapy of this type was accomplished by two or more physical therapists manually moving the patient's legs. Now, the Lokomat does most of the work, the pattern and pace of walking are more consistent, and the exercise can be continued for longer periods of time. The results of these studies will contribute to developing new strategies for helping people with SCI improve their ability to walk.

GAIT REHABILITATION

Dr. Lam also uses the Lokomat to better understand how sensory input and different levels of neural control interact to control our usual walking patterns. This is assessed by making detailed recordings of the individual's muscle activity patterns during walking as well as in response to brain or peripheral nerve stimulation while walking. In this way, we can gain a deeper understanding of the neural control of walking. Dr. Lam is also developing reliable, valid, and responsive means of measuring neurological and functional results. Almost half of all injuries to the spinal cord retain some function below the level of the lesion, and the majority of people with these injuries are able to recover some ability to walk. Since a significant proportion of people who sustain an SCI may expect to recover some ability to walk, these methods of measurement will be an important assessment of the value of new medical or rehabilitation strategies.

DR. WILLIAM MILLER

CANWHEEL RESEARCH TEAM

The CanWheel Research Team, led by Dr. William Miller, aims to improve the mobility of older adults using power wheelchairs. Dr. Miller and his team are investigating how power wheelchairs are presently used, and how they can be improved. Research projects include WheelCon — which assesses an individual's confidence when using a manual wheelchair — and the Wheelchair Outcome Measure (WhOM). The WhOM is a manual for clinical practice and research which assesses a person's satisfaction in day-to-day activities while using a wheelchair. To date, the WhOM manual has been sent to over a hundred locations in more than ten countries. SCI patients world-wide can experience improved quality of life as a result of this research.

DR. TOM OXLAND

A DYNAMIC COMPUTER MODEL OF SPINAL CORD INJURY

An SCI computer model was created by Dr. Oxland's group from high-resolution MRI data, and incorporates advanced material properties for the spinal cord, as well as the realistic flow of cerebrospinal fluid. Simulations of SCI yield a detailed picture of spinal cord deformation and stress throughout the injury process. Differences in cord stress and strain patterns can thus be investigated according to the injury mechanism and at varying velocities. These simulated injury patterns can then be compared to real measures of cord injury. The goal of this modelling is to increase understanding of the injury threshold for SCI with the possibility of more accurately predicting injury severity under a variety of scenarios.

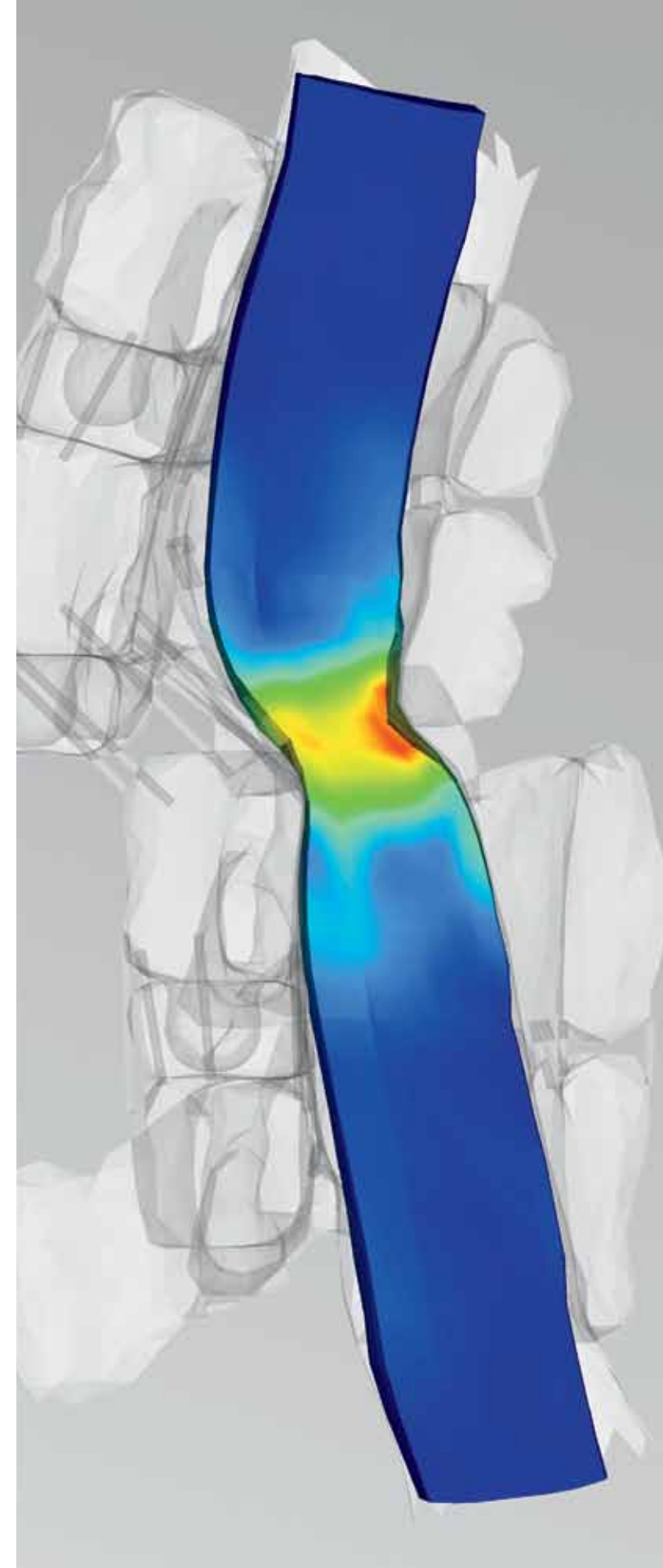
UNDERSTANDING THE MECHANICS OF SPINAL CORD INJURY

As Co-Director of the Orthopaedic and Injury Biomechanics Group, Dr. Oxland has focused his research team on understanding the mechanisms by which SCI causes damage to the spinal cord. Dr. Oxland's team, in collaboration with **Dr. Wolfram Tetzlaff** and **Dr. Marcel Dvorak**, has developed a range of models of these mechanisms, including a significant advancement discovered by **Dr. Anthony Choo**: that various injury mechanisms demonstrate differences in primary tissue damage and early secondary changes. The results of this work clearly indicate that different treatment strategies may ultimately be required for treating distinct types of SCI. Dr. Oxland's group is presently investigating changes in MRI results, and the effects of various treatment strategies on types of injuries.

DR. MATT RAMER

REPAIRING THE INJURED SPINAL CORD

Dr. Ramer and his team are not only interested in regrowth of injured nerve fibres, but also in the "rewiring" of spinal cord circuits which remain undamaged following spinal cord injury. Some of these changes can be beneficial, and Dr. Ramer's group has found ways of manipulating this changeability to improve recovery of sensation. Other changes, however, can lead to pain,





and the Ramer laboratory has made significant discoveries about why pain develops and how it might be prevented or even reversed. Dr. Ramer is also interested in the basic biology of nerve cells, about which he has made several important discoveries. He has described the qualities of a previously unrecognized set of neurons in the spinal cord, and discovered a new neuronal organelle which may govern the ability to regrow following injury. Dr. Ramer's work has been featured on numerous journal covers, and has been recognized by the Faculty of 1000, highlighting its impact in the biomedical sciences.

DR. BONNIE SAWATZKY

THE SEGWAY: MOBILITY AND THERAPY FOR INDIVIDUALS WITH SPINAL CORD INJURY

Dr. Sawatzky has been exploring the ability of the disabled population to use the Segway Human Transporter for mobility. Minimal physical function is required to operate a Segway, and it is usable by persons with complete paraplegia, using long leg braces. Surprisingly, this use of the Segway during therapy also reduces muscle spasms in SCI patients. The next phase of the project will involve a larger trial to understand the mechanism behind this improvement.

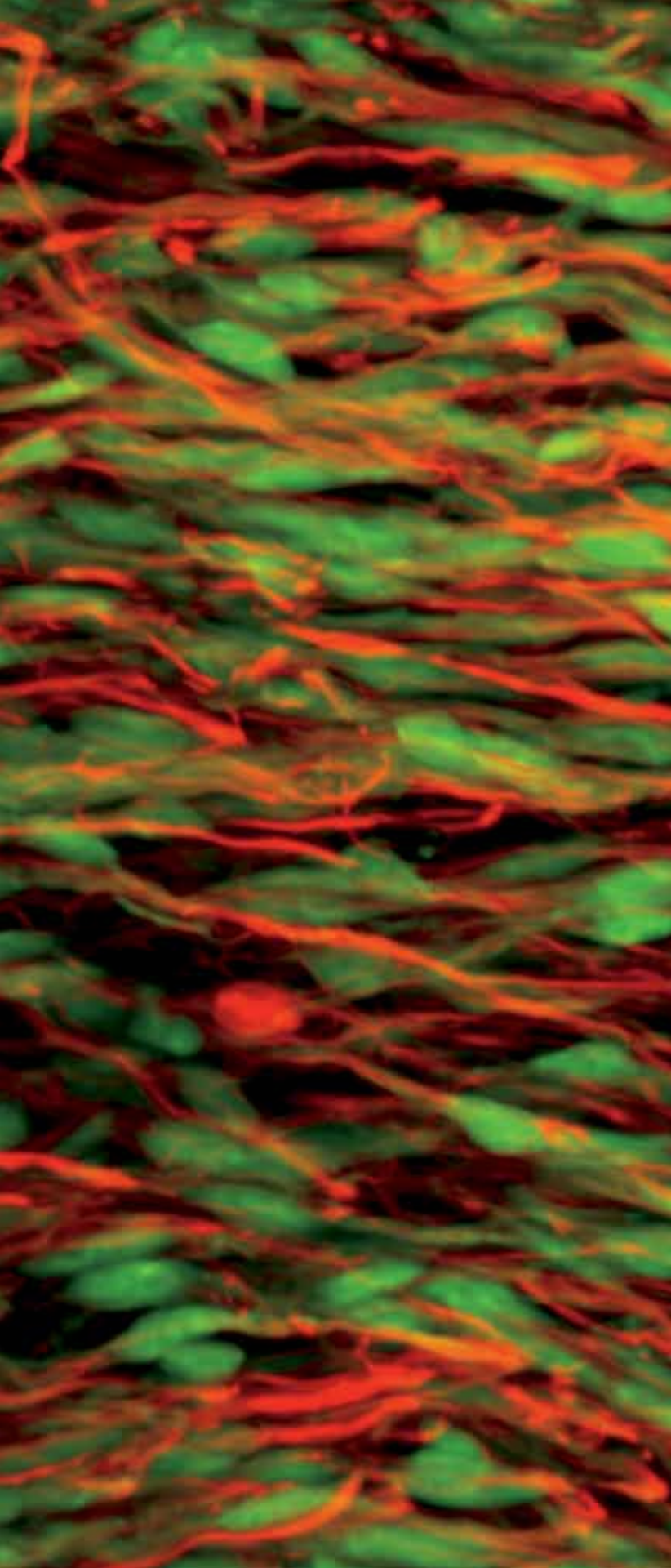
THE ERGONOMICS OF WHEELCHAIR PROPULSION.

Many manual wheelchair users experience pain and injury in their upper extremities. As many people with SCI must rely on a wheelchair for mobility, Dr. Sawatzky is examining the action of wheelchair propulsion—including why pain is less likely in those who began wheeling as children than in those injured as adults. Understanding the mechanics of wheelchair propulsion will help us reduce use-related injuries and increase wheeling efficiency. The data will be used to create a guide for recommendations to people with SCI. Additionally, Dr. Sawatzky is part of an international collaboration to create formal recommendations on the same issues regarding equipment and design, for appending to the existing 2005 Clinical Practice Guidelines.

DR. JOHN STEEVES

EXPERIMENTAL TREATMENTS FOR SPINAL CORD INJURIES

Dr. Steeves has contributed to many discoveries, including the detailed characterization of the critical descending pathways from the brain that are responsible for initiating movement, the identification of central nervous system (CNS) myelin as an inhibitor of SCI repair, and the development of human neurological and physiological outcome measures to accurately assess the potential benefits of a therapeutic intervention in a SCI clinical trial. Over his research career, Dr. Steeves has seen his research program transition from basic science to research focused on human studies to improve functional capabilities after SCI. For example, it was evident in 2004 that many discoveries relating to SCI were about to enter human clinical trials, but there were no guidelines on how to best conduct and complete a valid SCI trial. Dr. Steeves assembled an international panel of two dozen experts to examine the essential aspects of human SCI studies. This collaboration resulted in four highly cited publications, which are now widely accepted and adopted by most medical regulatory agencies, companies, and clinical investigators worldwide. In addition, Dr. Steeves coordinated the writing of a public document for SCI patients and their families that describes, in simple language, what questions they should ask prior to accepting any experimental treatment. This public document has been translated into many languages and has been downloaded, free of charge, hundreds of thousands of times. It enables the public to make informed decisions about the wide number of treatments being offered for SCI.



DR. WOLFRAM TETZLAFF

SURVIVAL OF CHRONICALLY INJURED RUBROSPINAL NEURONS

In 2002, Dr. Tetzlaff's laboratory demonstrated that chronically injured rubrospinal neurons, which are cells responsible for voluntary movement of the body, survive for more than one year after SCI. Previous reports had claimed as many as half of these neurons died during this time, but Dr. Tetzlaff's laboratory determined that the previously observed cell losses were due to shrinkage through lack of use, rendering the neurons undetectable, but not dead. In addition, these neurons could be rescued and stimulated to partial regeneration. This work was recognized by the National Institute of Health and selected for a replication study which became unnecessary when a prominent Dutch research group confirmed the findings.

MINOCYCLINE: A NEUROPROTECTIVE STRATEGY

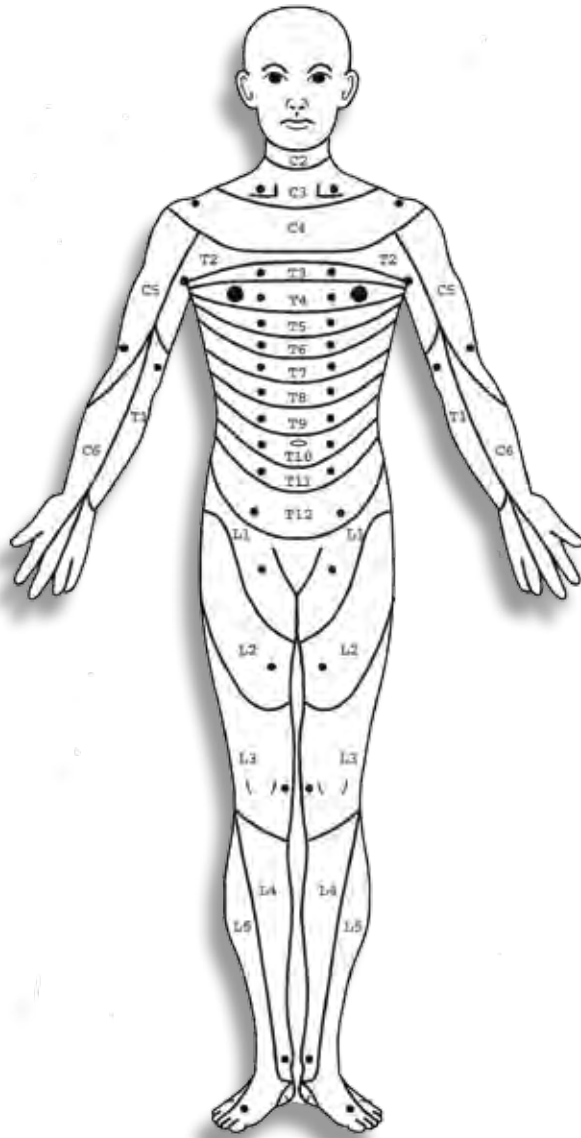
In 2004, Dr. Tetzlaff's laboratory demonstrated that minocycline, a clinically used antibiotic, would protect cells after SCI. A post-injury intervention with minocycline was successful in Dr. Tetzlaff's laboratory among others, and a clinical trial is now underway at the University of Calgary for a small cohort of SCI patients, and showing some promise with this group.

SKIN-DERIVED STEM CELLS USED FOR TRANSPLANTATION

Working in collaboration with **Dr. Freda Miller** from Toronto, Dr. Tetzlaff's laboratory showed new promise for spinal cord repair by deriving precursor cells from skin, and then encouraging these precursors to develop into Schwann cells, which function to support and maintain nerve cells. Using animal models, Dr. Tetzlaff demonstrated that following SCI these transplanted cells integrate into the injury, promote healing of the nerve cells, and improve functional recovery. More recently, Dr. Tetzlaff has shown that transplanting these cells is still successful even eight weeks after SCI. These results may enable patients to generate their own cells for SCI treatments, avoiding the ethical issues of fetal-derived stem cells and the difficulties of immune system rejection.

NEUROPROTECTIVE DIETS

In 2008, Dr. Tetzlaff's work revealed that fasting on alternate days, starting at the time of injury, promotes the regrowth of nerve cells, and recovery of function after SCI in animal models. Initially this work was received with some skepticism, and as a result Dr. Tetzlaff's group turned their focus to a different approach: a high-fat, adequate-protein, low-carbohydrate diet. Interestingly, this diet has also been shown to be beneficial to nerve cells, and to improve the post-injury outcome in models of animals with SCI.



DR. ANDREA TOWNSON

THE DEVELOPMENT OF INTERNATIONAL CLASSIFICATION OF FUNCTIONING FOR SCI

In 2007, Vancouver was one of only two North American study sites for an international collaboration organized by the World Health Organization. This initiative developed the International Classification of Functioning (ICF) core sets for SCI. Dr. Townson took part in the project, which also resulted in the development of important international relationships with colleagues in the United States and Europe. The project also increased awareness of the ICF amongst clinicians and provided an opportunity for local clinicians to be involved in the research.

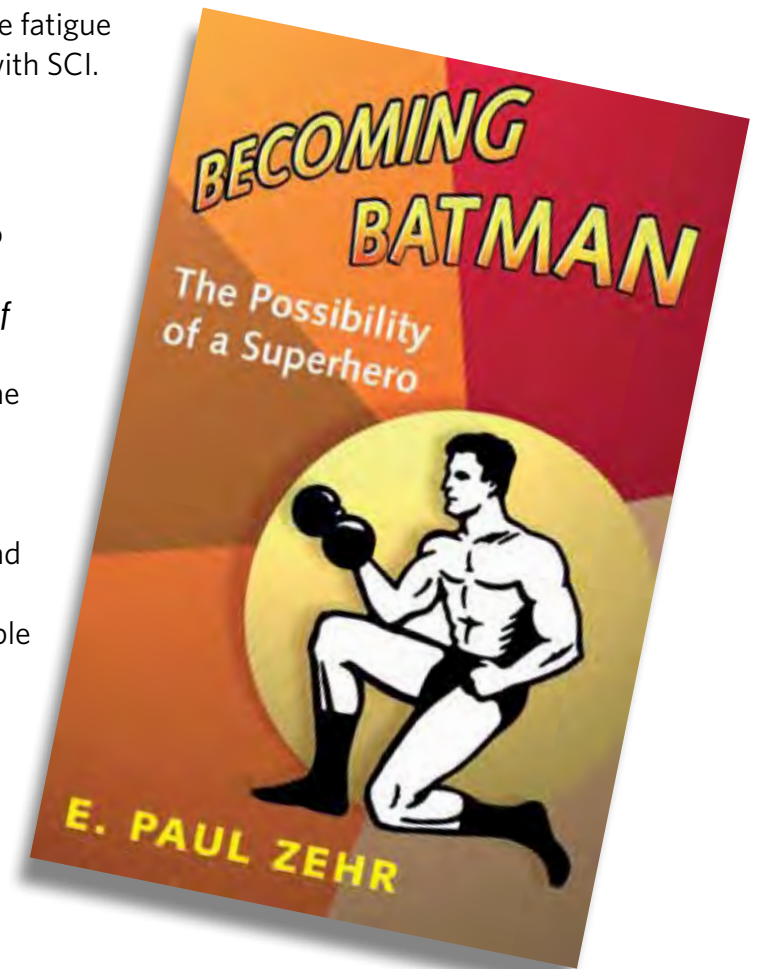
FATIGUE AND FUNCTION IN NEUROLOGIC AND NEUROMUSCULAR DISORDERS

Fatigue is a common complaint following SCI and can have a significant effect on the quality of life for people with SCI. Dr. Townson and colleagues **Dr. Bill Miller** and **Dr. Hugh Anton** are exploring the prevalence of fatigue among individuals with disabilities to determine its influence upon function and quality of life. In addition, their research considered potential approaches to improve treatments. The team has completed several studies increasing the understanding of how to measure fatigue and some of its contributing factors in people with SCI.

DR. E. PAUL ZEHR

SUPERHERO SUPERSCIENCE

Dr. Zehr is passionate about bringing science to the general public and empowering people. His recent books *Becoming Batman: The Possibility of a Superhero* (2008) and *Inventing Iron Man: the Possibility of a Human Machine* (2011) explore the science and technology behind rehabilitation and personal development in a popular style that can be appreciated by all, while remaining scientifically valid. The characters of Batman and Iron Man—human beings exploring their full potential—provide a central theme to help people with SCI consider the possibilities of physical improvement available through hard work and personal achievement.





research endowments

ICORD's research towards the development and translation of more effective strategies to promote prevention, functional recovery, and improved quality of life after spinal cord injury is enriched by five endowments. Interest generated by these endowments has provided for the establishment of four Chairs and a Professorship. Chairs and Professorships allow outstanding researchers to focus upon particular areas of interest. The aim of each ICORD chair is to bolster and enhance ICORD's research program.

ICORD's research endowments were established through the generous support of the Rick Hansen Foundation, the University of British Columbia, Vancouver Coastal Health, Mr. John and Ms. Penny Ryan, Ms. Cordula and Mr. Günter Paetzold, and the Province of British Columbia.

ICORD's Endowed Chairs

*Rick Hansen Man In Motion Chair
in Spinal Cord Injury Research*

BC Neurotrauma Professorship

*John & Penny Ryan BC Leadership
Chair in Spinal Cord Injury Research*

*Cordula & Günter Paetzold Chair in
Spinal Cord Injury Clinical Research*

Spinal Cord Rehabilitation Chair

**DR. WOLFRAM TETZLAFF: THE RICK HANSEN MAN IN MOTION CHAIR
IN SCI RESEARCH, 1995–present**

As one of the earliest members of ICORD, Dr. Tetzlaff has seen many advancements in his research program. His significant findings include the discovery that nerve cells previously believed to be dead after spinal cord injury do instead survive in a shrunken state and can actually be revived. “This is important because it opens the door for the eventual treatment of chronically injured people,” he says. In addition, Dr. Tetzlaff’s lab shared in the discovery that minocycline, primarily used to treat acne and other skin infections, can effectively improve the outcome after spinal cord injury by virtue of dampening inflammation. This vital discovery is now in clinical trials and larger studies are expected soon.

“More recently,” says Dr. Tetzlaff, “we have happened upon something we are very excited about. We have discovered, in animal models, that diet has a potentially strong impact on reducing the negative outcome of an injury.” This remarkable finding has led Dr. Tetzlaff and his team to develop an interesting dietary strategy for SCI.

While diets may mitigate secondary damage in the post-injury phase of SCI and improve the outcome, treatments to actually repair the injured spinal cord are also required. To address this, Dr. Tetzlaff’s team is studying the potential of skin-derived stem cells in the injured spinal cord, originally discovered by his collaborator Dr. Freda Miller in Toronto. As they observe, “We are very excited to see these cells bridging the injury sites and promoting myelination and nerve fibre regeneration in the injured spinal cords of rats, even if we transplant them as late as two months after the lesion. ICORD provided the essential state-of-the-art facilities for this study, and these could not have been built without the Rick Hansen Foundation’s support. We are immensely grateful for that.”

Originally from Germany, where he trained as an MD, Dr. Tetzlaff relocated to Canada in 1986 and received his PhD in Medical Science (Neuroscience) from the University of Calgary in 1989. Today his research is thriving at ICORD.

“At ICORD, I am able to see my clinical colleagues on a regular basis so that I have a better understanding of the problems they face on the clinical front. ICORD has provided an immense, unique opportunity. And holding an endowed position established by the Rick Hansen Foundation has freed up a lot of my time for research, for which I am very thankful.”



DR. MATT RAMER: THE BC NEUROTRAUMA PROFESSOR, 2001-present

After completing a three year post-doctoral fellowship in England, Dr. Ramer took up his first faculty appointment with ICORD as the BC Neurotrauma Professor in 2001. Since then, Dr. Ramer's laboratory has made several important advances in SCI research.

Dr. Ramer applies his expertise in the development of the nervous system to the problems of nerve fibre growth following injury. One of



the main questions the Ramer lab asks is whether the remarkable ability of a developing nervous system to grow and make connections can be revisited in adults with SCI. Neurotrophins, a class of growth-promoting proteins made in embryos, are scarce in adulthood, and Dr. Ramer's group has been investigating the effects of neurotrophin treatment. They have shown that while some of these are highly effective at encouraging regrowth of damaged nerve fibres in the spinal cord, others are ineffective, and in some cases even hinder recovery by blocking nerve fibre growth. Understanding why this happens will lead to better treatments for SCI.

The Ramer laboratory also investigates how "support cells" of the nervous system (collectively known as *glia*) influence growth of nerve fibres. His team showed that astrocytes, glial cells regarded as inhibitory to nerve fibre growth, are not necessarily so. He has also found that genetic manipulation of Schwann cells, glial cells found in the peripheral nervous system, markedly enhances their ability to support nerve fibre growth, even in the challenging environment of the damaged spinal cord. Dr. Ramer has also been investigating other "microglial" cells in the spinal cord, which produce molecules participating in the "re-wiring" of spinal pathways left undamaged by injury. Known as "plasticity", this flexibility is another promising avenue for a cure.

As an ICORD discovery scientist and BC Neurotrauma Fund Professor, Dr. Ramer carries out work to unravel the basic workings of the spinal cord, and the numerous changes that occur following injury. According to Dr. Ramer, "basic research is absolutely fundamental to the development of a cure."

**DR. JOHN STEEVES: THE JOHN AND PENNY RYAN
BC LEADERSHIP CHAIR, 2002-2010**

“The most effective discoveries often come at the boundaries between disciplines, not within the discipline,” notes Dr. Steeves. As the founding Director of ICORD, Dr. Steeves’ vision was to establish a nucleus of investigators that would encourage collaboration and integration of research on multiple levels, and one that would focus on a trans-disciplinary approach. Today, that vision has been achieved, and as ICORD’s John and Penny Ryan BC Leadership Chair, Dr. Steeves played a major role in the development of ICORD and has watched it grow into an internationally leading SCI research centre.

Dr. Steeves was the first BC Leadership Chair appointed and supported by the Province of BC in 2002. With contributing support from John and Penny Ryan, The Rick Hansen Foundation and UBC, this honour recognized Dr. Steeves’ scientific achievements in the field of SCI research, as well as his international stature as an innovative leader. Over his ongoing research career, Dr. Steeves has seen his extensive research program transition from basic science to research focused on human studies for improving functional capabilities after SCI. “Those transformations would not have come about had I not been surrounded and influenced by a variety of research colleagues at ICORD who identified solutions to meet the needs of people living with SCI.”

The John and Penny Ryan BC Leadership Chair also provided Dr. Steeves the opportunity to devote his energy towards building ICORD into a world-leading, trans-disciplinary research group. The completion of the Blusson Spinal Cord Centre solidified the vision and provides a solid foundation for future SCI research.

As Dr. Steeves explains, “what we’ve accomplished as a group at ICORD has been done on the basis of hard work and effort by scientists and clinicians who have enjoyed support from various organizations, including: the community of people living with SCI, the Government of Canada, the Province of BC, UBC, the Rick Hansen Foundation, Stewart and Marilyn Blusson, and for me personally, John and Penny Ryan. Their support has ensured that a highly qualified group of independent researchers can lead the way to providing effective solutions for SCI.”



DR. ARMIN CURT: THE SPINAL CORD REHABILITATION CHAIR, 2005-2008

A trained neurologist with expertise in clinical neurophysiology, Dr. Curt has worked with SCI patients for more than 15 years. Today, Dr. Curt is based at the University of Zurich, where he is Professor and Chairman of SCI Rehabilitation.



Dr. Curt began his work at ICORD in 2005 and was ICORD's first holder of the Spinal Cord Rehabilitation Research Chair. "What initially attracted me to ICORD," says Dr. Curt, "was the combination of preaching good science and the engagement of clinicians. ICORD provides a unique opportunity to combine basic researchers, clinicians, and outpatient clinics all under one roof in immediate proximity of a strong trauma centre. All of these different stakeholders, who are important for fruitful and successful rehabilitation research, can work together. This is something which is rather unique around the globe."

While at ICORD, Dr. Curt implemented clinical neurological measures in patients with acute SCI to better understand how spinal cord damage evolves over time. Donor support made a significant impact on Dr. Curt's work. "For some of my research, it's been fundamental because [the research] would not otherwise be funded by typical research agencies. ICORD is one of the very few centres that support the kind of work that is fundamental to understand the very specific conditions in our patients." By taking results from translational research and linking it to patients, Dr. Curt and his team made significant gains in improving the diagnosis in acute SCI patients. As he describes it: "I think one of the most important aspects of ICORD is that we are able to translate preclinical research into clinical meaning, and this allows us to have a direct impact on a patient's life."

DR. MARCEL DVORAK: THE CORDULA AND GÜNTER PAETZOLD CHAIR IN SPINAL CORD CLINICAL RESEARCH, 2005-present

When Dr. Dvorak was in residency training at UBC in the late 1980s, SCI was treated much differently than it is today. "During that time a lot of patients were treated non-operatively," he says.

"You can imagine being recently injured, trying to get a handle on the fact that you are partly or more profoundly paralyzed, and then going through this prolonged period of bed rest and traction. This was an extremely difficult experience for patients."

Today, thanks to advances in spinal cord clinical research, there has been significant improvement in patient care. "The most impressive changes that I've seen have been related to the provision of clinical care. The advances in our ability to safely operate on the spine, to stabilize the spinal column, and to decompress the spinal cord by carefully removing bone and disc fragments, improves the patient's experience and outcome dramatically," says Dr. Dvorak. "Instead of leaving newly injured people on bed rest for what used to be months and months, we can now stabilize the spine so that it is actually stronger than it was prior to the injury and create an environment for the injured spinal cord that is free of compression and optimal for neurological recovery. This allows the patient to get up out of bed, to start transferring, to do whatever they can within their abilities and to start to get back into a more normal life. There have been tremendous advances in our ability to care for those with acute spinal cord injury since I first started my practice."

Since accepting the Cordula and Günter Paetzold Chair in Spinal Cord Clinical Research in 2005, Dr. Dvorak and his team have contributed to the evidence that has driven improvements in clinical care. With the support provided by this endowed chair the spine program has been able to focus their collective research interests on the priority of striving to help people with SCI. "We have a responsibility to try to make the lives of our patients better," he says. "Working with SCI patients day after day, you recognize that there is a desperate need for something more to be done. It's more than just fixing them and getting them out the door...it's about finding a cure."





ICORD is a truly unique research centre that has, from its earliest inception, recognized the value of community-based involvement and partnership. Throughout the past ten years, the BC Paraplegic Association has been one such proud community partner. Over the next decade, we look forward to continuing to strengthen the bidirectional connection between SCI research and the thousands of British Columbians with SCI who benefit from it.

- Dr. Chris McBride

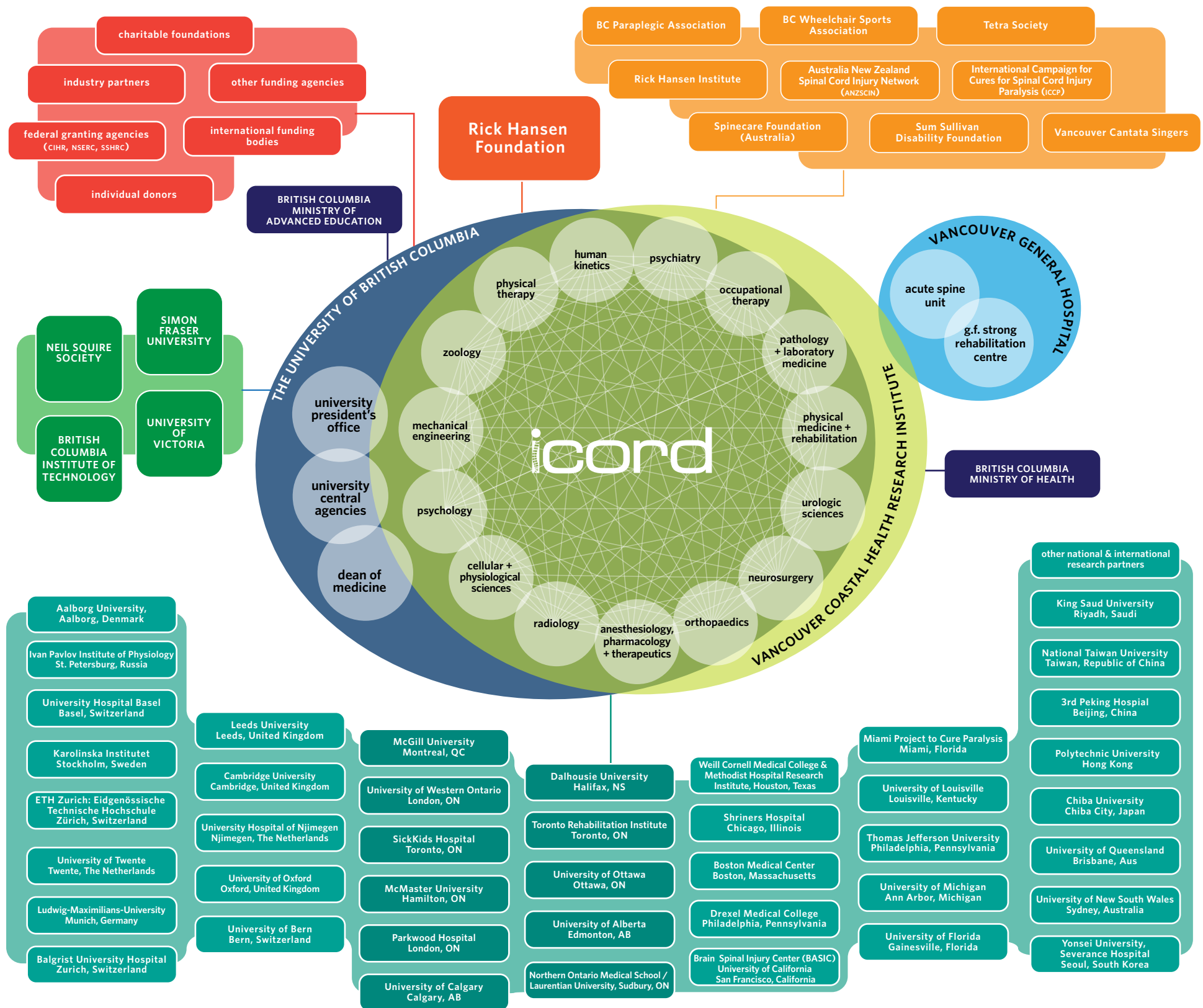
EXECUTIVE DIRECTOR, BRITISH COLUMBIA
PARAPLEGIC ASSOCIATION

partners make the difference

It has truly been said that any group is greater than the sum of its parts, and ICORD is a testament to that philosophy. Just as individual researchers share insights and advances, the larger organization itself benefits immensely from association with our myriad partners.

ICORD would not exist without the founding partnership of the Rick Hansen Foundation, UBC and Vancouver Coastal Health. Other funders and institutional partners nurture research projects and further our research directions. Community partners energize and inspire researchers in new and exciting ways.

Partnership is a uniquely empowering notion. As much as an individual can accomplish alone, those accomplishments increase exponentially when partners share achievements, ideas, and resources. ICORD is enriched in so many ways by the connections and powerful cross-pollination brought about through interaction with our partners, and for that we are sincerely grateful.



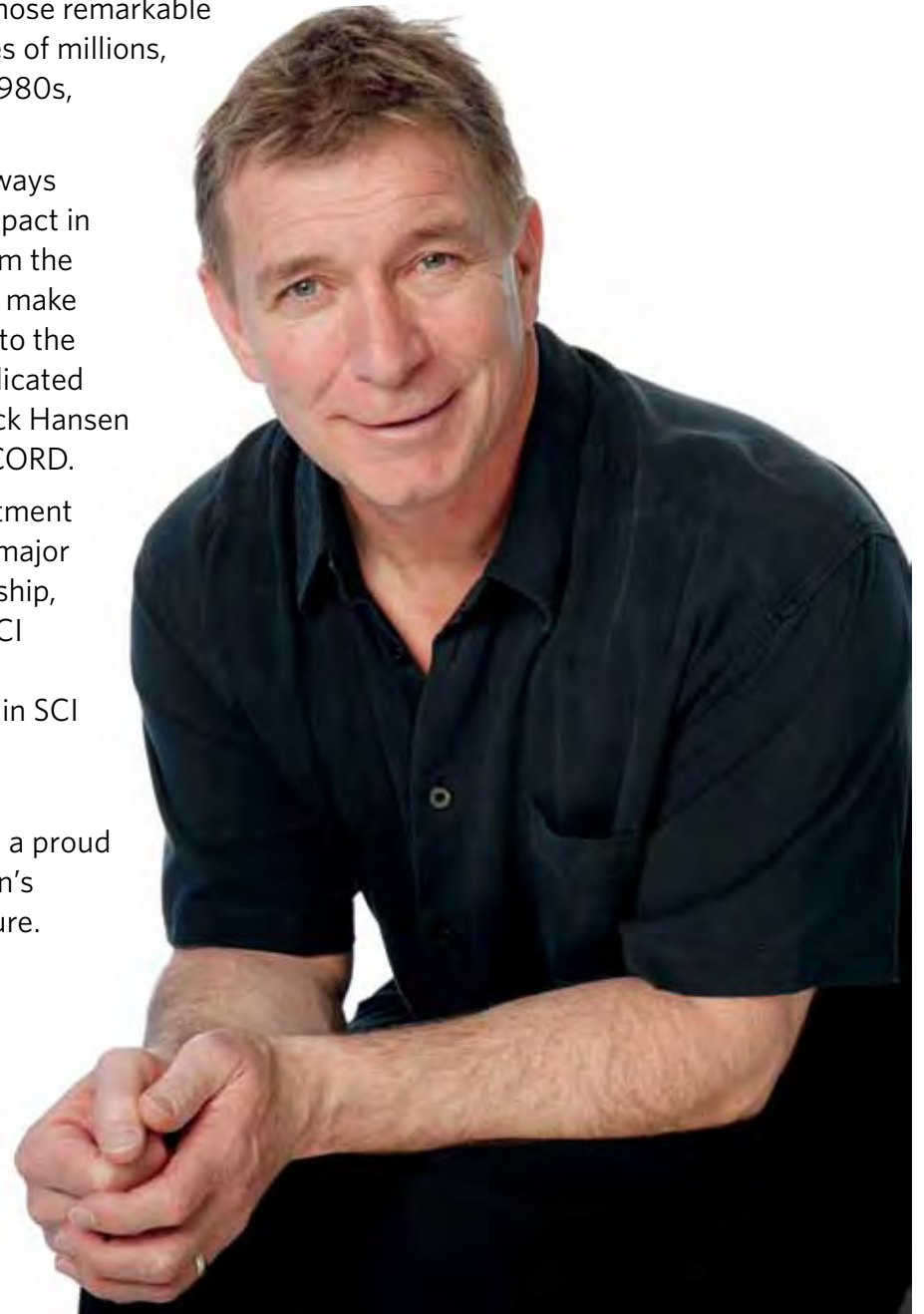
legendary inspiration: a profile of rick hansen

He has been described as having “true grit”, “a major influence”, and “a Canadian icon”. Today, there is no question that Rick Hansen is the epitome of determination. He is a man whose remarkable contributions and tireless efforts have made a significant difference in the lives of millions, and since he became Canada’s leading advocate for spinal cord injury in the 1980s, tremendous advancements have been made in science for those with SCI.

Following his epic Man In Motion World Tour, Rick Hansen began to look for ways to accelerate the pace of discovery so that it could have a more immediate impact in the day-to-day lives of people with SCI. In 1995, Rick and Dr. John Steeves from the University of British Columbia came up with a way to achieve this goal – to make basic research more relevant to people with SCI by getting new discoveries into the community more quickly and efficiently by establishing CORD, a group of dedicated UBC and Vancouver Coastal Health (VCH) researchers and clinicians. The Rick Hansen Foundation contributed generously to support CORD, which later grew into ICORD.

The driving force behind the development of ICORD, Rick’s vision and commitment has helped create one of the largest SCI research facilities in the world and a major destination for scientists and doctors around the globe. Because of his leadership, generosity, and fortitude, the Blusson Spinal Cord Centre, home of ICORD’s SCI Research Centre, was made possible. Rick’s guidance also helped to establish ICORD’s five research chairs, including the Rick Hansen Man in Motion Chair in SCI Research held by Dr. Wolfram Tetzlaff.

ICORD’s vital research endowments include the Rick Hansen Spinal Cord Endowment which significantly contributes to the work we do every day. As a proud partner of the Rick Hansen Foundation, ICORD strives to realize Rick Hansen’s dream of improving the lives of people with SCI—and ultimately finding a cure.



Rick Hansen
Foundation



other supporters and granting agencies

The generous support of **Rick Hansen, Stewart and Marilyn Blusson**, the **Canada Foundation for Innovation**, the **British Columbia Knowledge Development Fund**, **Vancouver Coastal Health**, **Vancouver Coastal Health Research Institute**, and the **University of British Columbia** has helped us to become a world leader in SCI research.

With a common goal of discovering and implementing meaningful solutions for people with spinal cord injury, ICORD researchers receive several million dollars annually in competitively-funded research grants. We are pleased to recognize the tremendous commitment of the funding agencies and foundations who have provided major grant funding to our researchers. As well, we are grateful for the generous donations made to ICORD by **John and Penny Ryan**, the **Aaron Moser Foundation**, the **Hong Kong Spinal Cord Injury Foundation**, **King Saud University**, and other private donors. Every donation, large or small, is sincerely appreciated and put to good use furthering ICORD's mission.

THESE ORGANIZATIONS HAVE PROVIDED SIGNIFICANT GRANTS TO ICORD OR ICORD RESEARCHERS:



local research partners

Although ICORD is an interdisciplinary research centre in UBC's Faculty of Medicine and Vancouver Coastal Health Research Institute, a number of our researchers belong to other Canadian institutions. The support provided to our researchers by these institutions continues to be invaluable.



national and international research partnerships

ICORD researchers have an extensive network of national and international collaborations with investigators from a wide range of prestigious hospitals, universities and SCI researchers. An illustration showing of some of these collaborating institutions is shown on page 35.



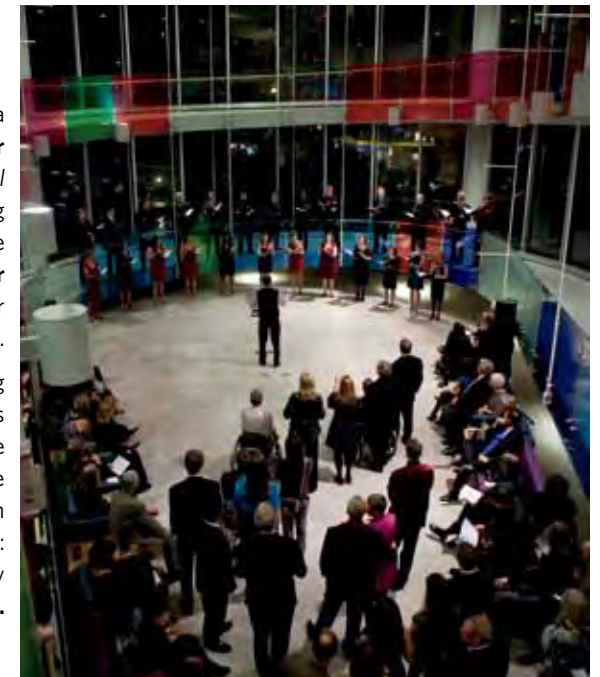
community partners

ICORD clearly has expertise in knowledge translation; however, we can more effectively move towards defining best practices and policy changes by forming important partnerships with organizations such as the **Rick Hansen Institute**, **BC Paraplegic Association** and the **Sam Sullivan Disability Foundation**. Our partnerships and community engagement, combined with interdisciplinary research and external communication, will allow ICORD to continue to be a leader in the search for a cure.

Partnerships with other organizations such as **BC Wheelchair Sports** and the **Tetra Society** afford new opportunities to forge links with the SCI community, and our fundraising partnership with the **Vancouver Cantata Singers** has proven to be rewarding in many ways for both organizations.

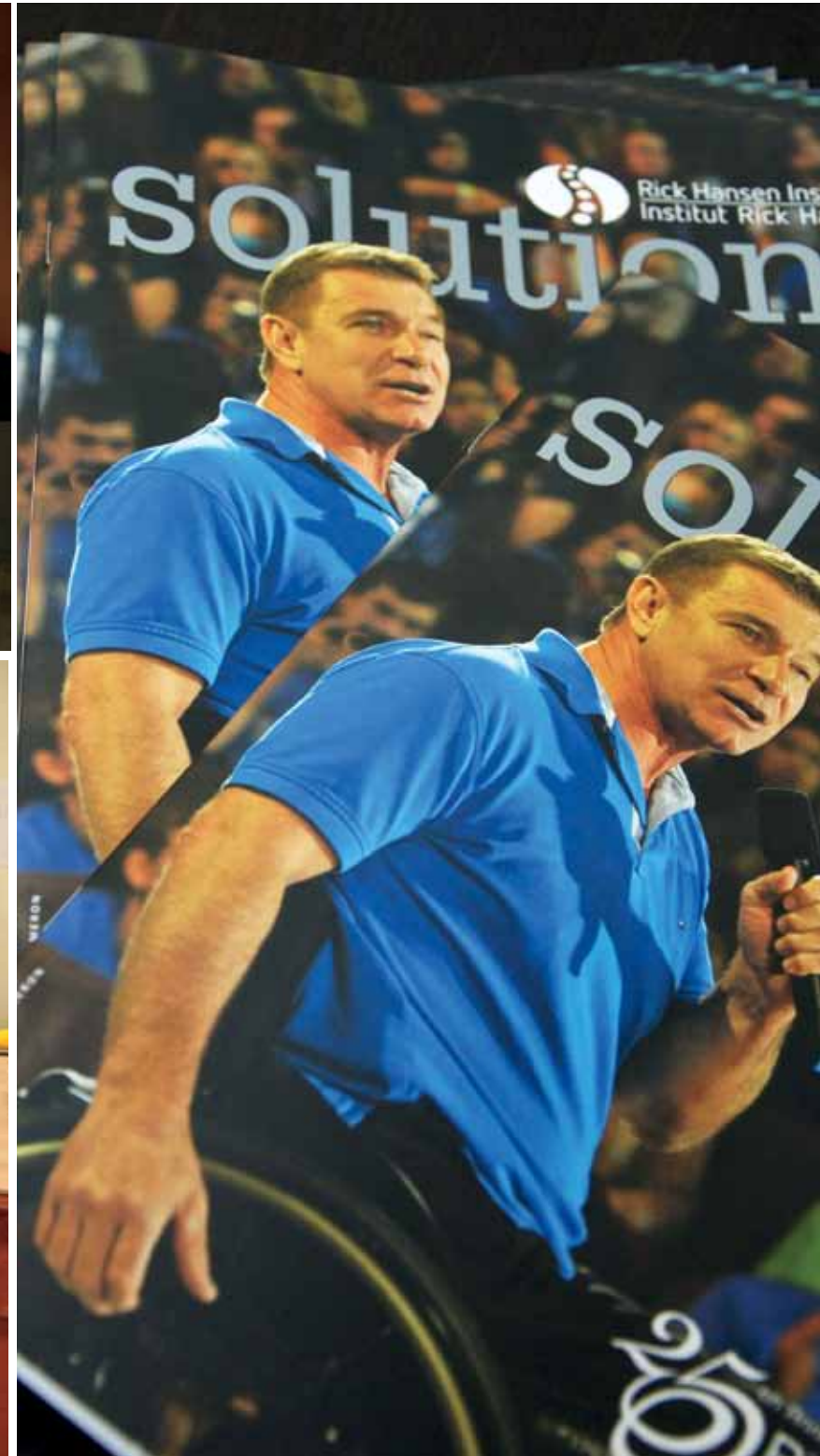
This page (right): Guests enjoy a performance by the **Vancouver Cantata Singers** during *Spinal Chord*—a joint annual fundraising gala in support of ICORD and the VCS; (below) **BC Wheelchair Sports Association's** Summer Camp for Kids.

Opposite page (top left): meeting of the **BC Paraplegic Association's** Peer Associates; (bottom left): the **Tetra Society** workshop in space provided by ICORD at the Blusson Spinal Cord Centre; (right): *Solutions Magazine*, produced by the **Rick Hansen Institute**.



Sam Sullivan
DISABILITY FOUNDATION





The development of ICORD has allowed me and my fellow researchers to bring in significant granting funds and publish in solid peer reviewed journals. Additionally, faculty members do not waste time traveling back and forth to meetings, since we are all under one roof. We've had highly productive meetings, resulting in better research and outputs. Many therapists in Vancouver and around the world have told me that my research in improving wheeled mobility for SCI has changed their practice of what they prescribe and recommend to their clients. We are making, and will continue to make, a difference at ICORD.

- Dr. Bonita Sawatzky

ASSOCIATE PROFESSOR, ORTHOPAEDICS, UBC & VCH

looking back

ICORD researchers take a look back on the past ten years and comment on how SCI research, as well as how quality of life for people with SCI, has improved. We asked:

Are people with spinal cord injuries better off today than they were ten years ago?

How has your research program changed in the past ten years?

What is the true value of Rick Hansen's investment in ICORD?



Although many challenges are still to be faced, research into the basic science of SCI and the search for a cure has moved forward in the past ten years. Survival after SCI has improved, and we are now focusing on the long-term health issues associated with living with SCI. There is an increased awareness of disability and the greater inclusiveness in society generally. Of course, we still have a long way to go and, in some respects, the journey is only just beginning.

- Dr. Hubert Anton

CLINICAL ASSOCIATE PROFESSOR, PHYSICAL MEDICINE AND REHABILITATION, UBC

In 2000, ICORD and the Rick Hansen Foundation provided funds which I leveraged through the Michael Smith Foundation to create a two-photon imaging and electrophysiology facility that has been used to explore synaptic plasticity and neuronal properties. Over the intervening years there have been collaborations with other ICORD researchers, mainly in the area of dorsal root regeneration. The technology we developed has been replicated in several neurophysiology laboratories at UBC, and beyond, and is being used to study brain injury and plasticity, the value of which is collectively more than 10 times the initial investment.

- Dr. Kerry Delaney

PROFESSOR, BIOLOGY, UVIC

ICORD is solely responsible for making me a clinical researcher. The support I have has allowed me to invest the time to learn from ICORD mentors, and these interactions have widened the depth of my questions and investigation. ICORD has made the quality of our research better, so much so that it is now published in high impact journals. In terms of sexual and fertility rehabilitation, we have been able to reach a much wider audience than our local environment, resulting in an awareness and a therapeutic movement with much bigger appreciation in SCI conferences worldwide.

- Dr. Stacy Elliott

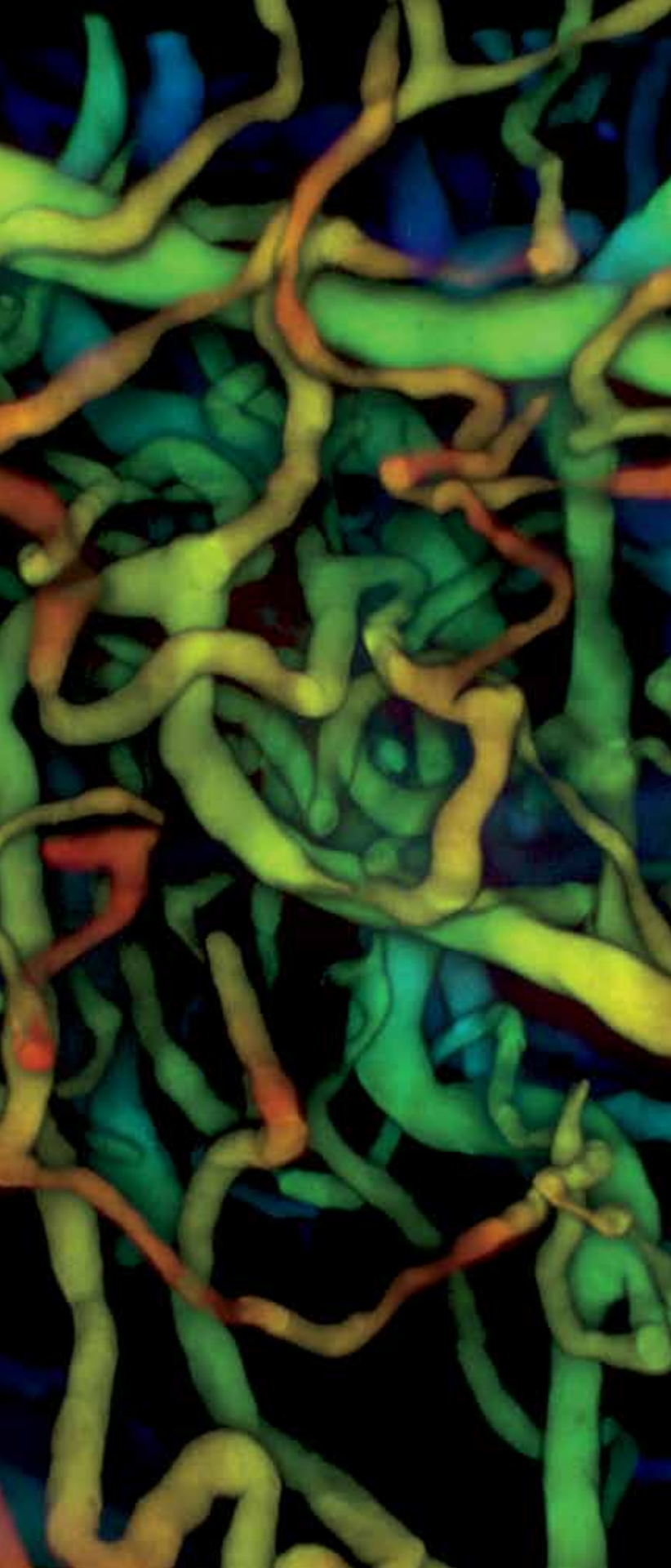
CLINICAL DIRECTOR, BC CENTRE FOR SEXUAL MEDICINE; CO-DIRECTOR, VANCOUVER SPERM RETRIEVAL CLINIC;
SEXUAL MEDICINE CONSULTANT, GF STRONG REHAB CENTRE, UBC & VCH

People with SCI today are better off than they were ten years ago thanks to many factors, including the free flow of information from the internet. There is an abundance of information that is available to the consumer with SCI. Our website, SCIRE, is one credible place where patients can get information about their condition and treatments. Because patients and their families are so well-informed, it is now very common for patients to be strong advocates of their own health care. They are knowledgeable about their condition, and rightly demanding for treatments with the best outcomes possible.

- Dr. Janice Eng

PROFESSOR, PHYSICAL THERAPY, UBC & VCH





ICORD both receives value from and contributes to the success of the Rick Hansen Foundation, forming a strong synergistic relationship. ICORD gives the RHF great credibility in the effort to dramatically reduce, if not eliminate, the functional deficits that accrue to those who suffer an SCI event. The RHF has been able to make significant accomplishments for those who live with SCI. It must also invest in “cures” for the biological damage caused by SCI. RHF benefits from ICORD by having a well recognized group of scientists working to dramatically reduce the physical deficits for following SCI in the future. ICORD fulfills one of the prime mandates of the RHF.

- Dr. Thomas Grigliatti
PROFESSOR, ZOOLOGY, UBC

My research program has evolved quite a bit in the last ten years. Back then, I was starting the development of the fully implanted, pacemaker-like Neurostep system that assists walking in people with hemiplegia and foot drop. Five years ago, funded by the Rick Hansen Man in Motion Foundation, we developed, with Faisal Beg, a new method for 3D imaging of peripheral nerves. And, in the past four years I have switched my research focus to electrical pacing of the diaphragm as a means to help wean patients whose life depends on (and are at risk because of) mechanical ventilation.

- Dr. Andy Hoffer
PROFESSOR, KINESIOLOGY, SFU

The support of the Rick Hansen Foundation and Rick Hansen Institute has enabled my laboratory to make significant progress on the under-investigated and still poorly-understood area of autonomic control of arterial blood pressure following SCI. Funding from RHF was crucial to the establishment of an international collaboration with scientists and clinicians from Sweden and Russia to evaluate mechanisms of abnormal blood pressure following SCI and during exposure to microgravity. In another recent study funded by RHI, we demonstrated that better education of emergency room personnel and paramedics is needed in order to provide timely recognition and appropriate management of life-threatening episodes of high spiking blood pressure (known as autonomic dysreflexia, or “AD”). To address this need, we implemented a course entitled “ABC of AD” (a course similar to the well-known life-saving CPR course) which we hope will result in vast improvements in the lives of individuals with SCI by decreasing unnecessary emergency room visits and hospitalizations.

- Dr. Andrei Krassioukov
PROFESSOR, PHYSICAL MEDICINE AND REHABILITATION, UBC

Being situated in the Blusson Centre has enhanced my research program by bringing us closer to the spinal cord community, including people who are living with SCI, as well as other researchers and clinicians who work in the area of SCI care. Since the Blusson Centre is located closer to the other hospitals, there is also more opportunity for interaction with clinicians. My research program has grown a lot since becoming an ICORD Principal Investigator, as trainees are attracted to the research environment provided by ICORD.

- Dr. Tania Lam

ASSISTANT PROFESSOR, HUMAN KINETICS, UBC

People with spinal cord injuries are at an advantage today because there is better evidence to support interventions available to clinicians through initiatives like SCIRE, which synthesizes evidence for clinicians and families. This evidence promotes best practices, which lead to better outcomes post-SCI. There have been enhancements to outcome measurements which enable us to determine if interventions have actually led to improvements in individuals with SCI. Finally, there has been incremental improvement in the development of assistive technology, including wheelchairs and seating devices, which improve quality of life after SCI.

Dr. William Miller

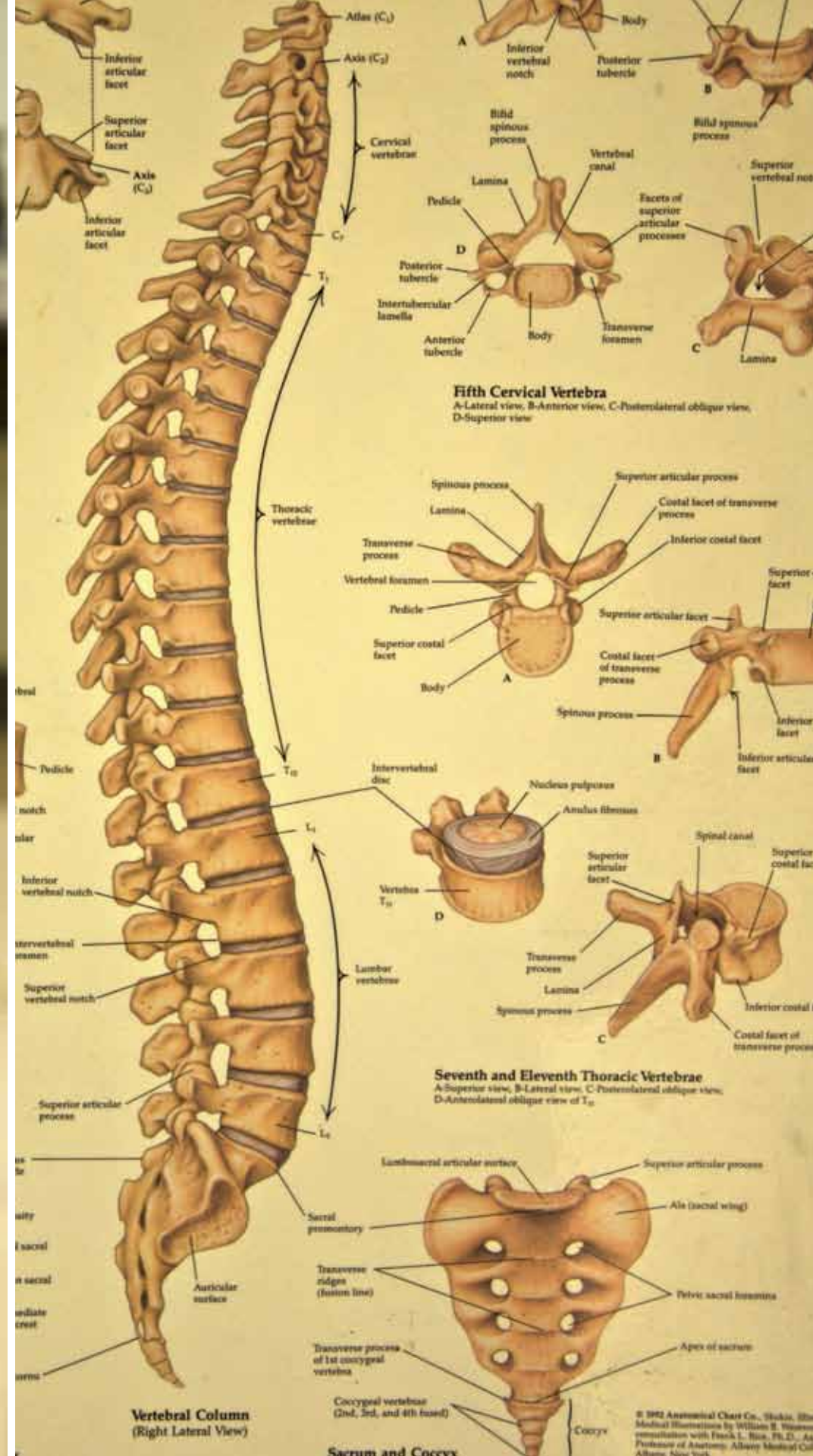
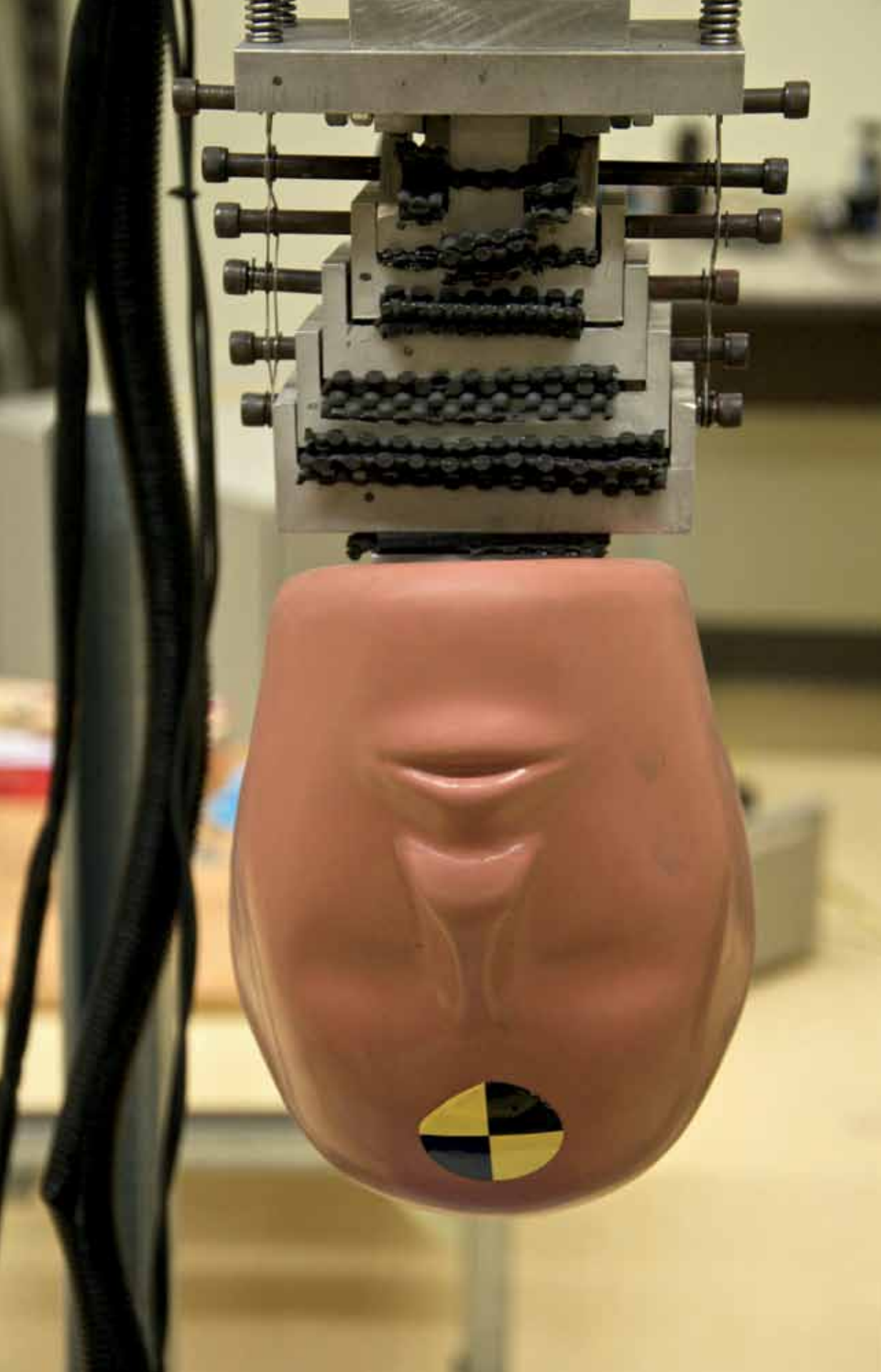
ASSOCIATE PROFESSOR, OCCUPATIONAL THERAPY, UBC

Prior to my involvement in ICORD, our lab was somewhat academically isolated in an area where there were very few other research labs. Since becoming involved with ICORD, and, particularly with the move of our lab to the Blusson Spinal Cord Centre, we have had a very positive experience with excellent interchange between other laboratories in a very collegial and nurturing environment. The extensive research on spinal cord injury biology, treatment and rehabilitation in many spheres over the past ten years at ICORD offers new hope and significant benefits to not only those with spinal cord injury but to anyone with any acquired injury to the central nervous system.

Dr. Wayne Moore

CLINICAL PROFESSOR, PATHOLOGY AND LABORATORY MEDICINE, UBC





The Rick Hansen Foundation's investment in ICORD is valuable because of the high degree of visibility, legitimacy, and respect that Rick Hansen and his organization command. There has been a noticeable shift away from a "cure-only" mentality to an expanded focus of improving the lives of those living with SCI. The recent announcement and funding of a Best Practices Initiative by RHI is an example of making things better for people living with SCI. In addition, there is less stigma surrounding SCI now than 10 years ago, as well as better recreation and vocation opportunities, and better equipment available.

Dr. Michael Negraeff

CLINICAL ASSOCIATE PROFESSOR, ANESTHESIOLOGY, PHARMACOLOGY & THERAPEUTICS, UBC & VCH

My association with ICORD has had a significant impact on my research, particularly the direction I have taken. Specifically, because of funding from Rick Hansen, through ICORD, I was able to initiate a series of high-risk experiments that took my research into new areas that we would not otherwise have explored. Also, my involvement with ICORD and the Rick Hansen Institute over the years has given me the opportunity to see the personal effects of SCI. While I am still a basic scientist, I have a much better appreciation of the often debilitating nature of spinal cord injury and the impact it has on society, and a new understanding of the importance of translational research.

- Dr. Tim O'Connor

PROFESSOR, CELLULAR & PHYSIOLOGICAL SCIENCES, UBC

My research program is more multidisciplinary than ever due to my involvement with ICORD. Our biomedical engineering research group has collaborated for many years with spine surgeons. ICORD brought investigators from other disciplines into our research activities, such that one of our most innovative programs over the past five to six years has involved experts in neuroscience and medical imaging. This multidisciplinary approach is beneficial to the research and to the trainees who learn about these other fields.

- Dr. Tom Oxland

ACTING DIRECTOR OF ICORD.

PROFESSOR, ORTHOPAEDICS AND MECHANICAL ENGINEERING, UBC & VCHRI

My research program has improved since I became an ICORD Principal Investigator in a number of ways. SCIRE has become a resource that is up-to-date and relevant to clinicians, researchers and people living with spinal cord injuries. I use it on a regular basis to guide my decision making in clinical practice, and as a tool for my patients. As a member of ICORD, I was also involved in the World Health Organization's project that brought together researchers from around the world to develop an International Classification of Functioning, Disability and Health (ICF) core data set for spinal cord injury. We were the only Canadian site and one of two North American sites participating in this project.

- Dr. Andrea Townson

CLINICAL ASSOCIATE PROFESSOR AND HEAD, PHYSICAL MEDICINE AND REHABILITATION, UBC;
MEDICAL SITE LEAD, GF STRONG REHAB CENTRE, VCH

looking forward

Since its inception, ICORD has grown into an unprecedented, world-leading research centre for UBC and Vancouver Coastal Health. Our many investigators and trainees have the unique opportunity to work directly with people who have SCI, and can therefore generate research at the most basic level, relevant to those who need it most. With this comprehensive approach, our research is not only focused on the future goal of a cure, but is dedicated to realizing solutions that will improve functional recovery, independence, community integration, and quality of life for people with SCI, both today and in the future.

Above all, our work is about providing hope for people throughout the world. As ICORD progresses toward achieving its vision, we will continue to improve the quality of life for people with SCI and accelerate the search for a cure by providing a home for groundbreaking research.





photographs

Front cover: [L-R] Kent Niamath, Wenyen Zhang, Lowel McPhail. Page 1: L. McPhail. Page 3: [L-R] W. Zhang, Wendy Niamath, W. Niamath, L. McPhail, Cheryl Niamath, courtesy Rick Hansen Foundation. Page 4: Mark Crawford & Matt Ramer. Page 5: C. Niamath. Page 6 & 7: Brian Kwon. Page 8: [bottom left] C. Niamath; [top left] courtesy RHF; [top right] courtesy M. Ramer; [bottom right] courtesy Musson Cattell Mackey Partnership. Page 9 [bottom left] courtesy RHF; [top left & bottom centre] W. Niamath; [bottom right & top centre] C. Niamath; [top right] courtesy Aaron Moser. Page 10: [bottom left] courtesy Marcel Dvorak; [top centre] Martin Dee; [bottom right] L. McPhail. Page 11: [bottom left] W. Niamath; [top left, both photos] M. Dee; [bottom right] L. McPhail; [top right] courtesy RHF. Page 12 [top left] Jie Liu; [all others] L. McPhail; Page 13: L. McPhail. Page 14: [top left] Clarrie Lam; [centre left] L. McPhail; [bottom left] C. Niamath; [bottom right] L. McPhail. Page 15: [both] L. McPhail; Page 16: Wolfram Tetzlaff. Page 17: Chris Chernoff. Page 18 + 19: L. McPhail. Page 20: [top] courtesy Andy Hoffer; [bottom] L. McPhail. Page 21: courtesy Vancouver General Hospital Foundation. Page 22: L. McPhail. Page 23: courtesy Tom Oxland. Page 24: C. Niamath. Page 26: W. Tetzlaff. Page 27 [top] courtesy American Spinal Injury Association; [bottom] courtesy Paul Zehr. Page 28: C. Niamath. Page 29 + 30 : L. McPhail. Page 31: Chris McBride. Page 32: W. Niamath. Page 33: courtesy M. Dvorak. Page 34 + 36: courtesy RHF. Page 37: Paul Lesack. Page 38 [top] Jesse Read; [bottom] courtesy BC Wheelchair Sports Association. Page 39: [all photos] L. McPhail; Page 40: M. Dee. Page 41: L. McPhail. Page 42: M. Crawford + M. Ramer. Page 43 + 44: L. McPhail. Page 47: M. Dee. Page 48: Collin Russell. Back cover: W. Niamath.



icord



a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Rick Hansen
Foundation



Vancouver
Coastal Health Research Institute
Healthier lives through discovery