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COVER PHOTO: Calgary's Christian Bagg at the controls of his new Bowhead RX aMTB. Photo courtesy of Bowhead Corp.



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Spinal Cord Injury BC

Accessibility: Beyond the Code

It was 20 years ago that I joined ICORD's management team. During my time as ICORD's Managing Director, one of the most interesting and rewarding projects I was involved with was the construction of the Blusson Spinal Cord Centre.

From ICORD's perspective, we were very clear that we wanted it to be the most accessible building of its kind for people with SCI and physical disabilities. We worked hard with the architects, engineers, and construction teams to ensure accessibility was always at the forefront of planning and decision-making. We needed to be vigilant because we weren't interested in simply meeting the minimum accessibility requirements of the building code—we wanted to go well beyond the code and ensure the building was maximally accessible.

As with any aspirational project, there were times when realities butted up against vision. I will always remember the response given by one of the general contractors when asked if we could re-design a certain space within the building to be more accessible. To paraphrase, the response was, "With enough time and money, we can build it however you want." Obviously, we had neither the luxury of unlimited time nor money, so compromises were made. But we tried to make them in areas of least impact. One example was in the construction of the building's iconic ramp, which provides accessible wheeled and walking access to the clinic and research floors. It was a costly feature, which required two concessions.

We felt it was so critically important that we sacrificed the project's research equipment budget to fund it. But we also sacrificed our vision of the ramp extending to all floors of the building because we didn't have sufficient funds or space. As users of the building likely still agree today, the time, space, and money compromises made to ensure the ramp was built were worth it.

I reflect on this experience often, and did so recently as the provincial government sought input on a much needed revamping of the *BC Building Code*. Yes, the code needs many improvements when it comes to building spaces that are accessible and inclusive of all. However, the code is just the minimum required. We need aspirational leadership and incentives to ensure new buildings in this province far exceed those minimum requirements.

The Blusson Spinal Cord Centre and other intentionally-designed accessible buildings have shown that good accessible design is appreciated by everyone. Good accessible design is welcoming and functional, and fosters inclusion.

It's my hope that the updated building code will push forward progressive changes to accessible design. However, I hope that, through the spirit of BC's new *Accessible BC Act*, developers and the building sector as a whole will be inspired and incentivized to build well beyond minimum standards for accessibility and embrace creative designs that make all buildings visitable, adaptable, and accessible.

This will take time and it does take money, but when accessible design is embedded from the concept phase onwards, the building process doesn't have to cost more or take longer. In other words, when accessibility is universally embedded in the development and design process, denying access to people with disabilities will no longer be a compromise that developers and builders will have to make.

—Chris McBride, PhD, Executive Director, SCI BC



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We acknowledge that The Spin is created on the traditional and ancestral territory of the Coast Salish peoples—Squamish, Musqueam, and Seilwiltuh (Tseil-Wautuh) Nations. Our provincial work takes place on the territories of Indigenous peoples who have lived on and cared for the land for time immemorial. We are grateful to work, share stories, and connect in these spaces.

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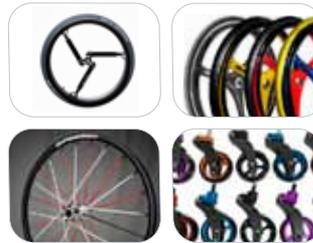
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KIZIK SHOES

Kizik spent six years developing a shoe with a heel that would expand and pop back into place as you step into it. There are no laces to tie or untie—you just step into them or pop them on with your hands. The secret sauce is a flexible F1-grade titanium arc in the heel that bends outward for entry, and then returns into place for a normal, snug fit. The Utah company has tested this lightweight metal component by compressing it more than 100,000 times with a hydraulic press. There are six different Kizik styles available, including leather low-tops and sportier sneakers. Learn more at kizik.com.

FLEXIMUG

Fleximug is a hands-free drinking system that's perfect for anyone who uses a wheelchair or has limited arm movement. The mug is a high quality stainless steel thermal container that's designed to keep your drink hot or cold for hours. The lid has a one-way valve and a detachable long reach straw that will maintain any position that it's bent into. The straws, which are easy to detach and replaceable, are available in sizes ranging from 24 to 36 inches. All components can be easily washed and rinsed, and are dishwasher safe. An included 18" tube brush comes in handy for cleaning the straw. It's compatible with most wheelchair drink holders. Check out fleximug.com for more details.



Innovations

New products, devices, and aids to daily living that might make a difference in your life...

WHEELAIR

Last summer's infamous heat bubble might be a distant memory, but odds are we'll experience similar events in the future. Enter the wheelAIR, a wheelchair back-rest cooling cushion designed to improve comfort and reduce body temperature by removing excess heat and moisture from the backs of wheelchair users. The system blows air onto the user's back with a battery powered fan. The battery recharges via USB, and provides up to 20 hours of cooling when used on the lowest setting. The fan's multiple speeds are controlled using a wireless remote. It's available in multiple sizes and can replace the seat backs of most manual and power chairs. Lots more details can be found at wheelair.co.uk.



T-PULL DOOR CLOSER

The T-Pull Door Closer installs in seconds on any interior or exterior door, making it easier to close for quadriplegics or anyone with limited hand strength and function. The unique handle shape and length makes it usable with only a single finger or even a closed fist. The handle also freely swivels to avoid straining a user's arm and shoulder. Installation is simple—you just peel off the back and stick it into place at the centre or closer end of any door. The handle tucks away when not in use, and easily pulls when needed. It's durable and strong, and can be mounted with screws for heavier door applications. More details about this Canadian-made innovation can be found at t-pull.com.



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Race in-person or virtually.

This year's Charity Challenge will be held in-person and online. On June 26, join us to celebrate Team SCI BC's 10th anniversary and race together again in Vancouver. Compete in a half marathon or in a friendly five kilometre race. You can also join the race online by wheeling, walking, or riding in your favourite BC community, or by doing your own virtual fitness program at home or the gym, between May 27 and June 26. Contact Jenna at jwright@sci-bc.ca to get onboard.



Connect with peers in Naramata.

In the months ahead, we'll be hosting three inclusive retreats at the beautiful Naramata Centre in the Okanagan. Join in for a chance to relax, meet new friends and try new activities at our Women's Retreat (April 1-4), our Wellness Retreat, which is open to all peers (May 6-9), and our Ambulatory Retreat for peers with incomplete injuries (June 17-20). Your safety is our priority, so proof of vaccination will be required. Contact Jenna at jwright@sci-bc.ca for info or to register.



Keep connections alive online.

As we slowly resume our in-person events, our province-wide online coffee groups, fitness sessions and games will still be available to you with the click of a mouse. Join in sessions through Zoom (you can also dial in by phone). Our amazing volunteer hosts and Peer Program Coordinators have a great array of activities to keep you connected and engaged. Visit sci-bc.ca/events or call our toll-free InfoLine (1.800.689.2477) for more information.

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sci-bc.ca/charity-challenge-2022

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This program is funded by the Government of Canada
and the Province of British Columbia.



Congratulations and respect to three SCI BC peers who have made a significant commitment to help identify accessibility problems in our province—and find solutions. Kamloops’ **JESSICA VLIEGENTHART** (left), Vancouver’s **KEN KRAMER** (middle), and Kelowna’s **SPRING HAWES** (right), were recently appointed by the BC government to its new Provincial Accessibility Committee. The committee is charged with providing government with expertise and recommendations aimed at improving accessibility for all British Columbians with disabilities as it works to implement the Accessible BC Act. With their fellow committee members, they’ll be developing and recommending accessibility standards to government, engaging with the public on the development of accessibility standards, and providing general advice to the Minister of Social Development and Poverty Reduction about government’s efforts to promote accessibility.

“Jessica, Ken and Spring all have busy careers and lives, and yet they’ve made this sacrifice to improve accessibility and inclusion in our province for all peers and those with other disabilities,” says Chris McBride, SCI BC Executive Director. “It’s a selfless commitment, and I commend and thank them for it—and I wish them well as they start work to make BC more accessible.”

You can learn more about the committee and the other members at sci-bc.ca/committee.



Vancouver’s **VICTORIA FEIGE** has cemented her reputation as one of the best adaptive (or para) surfers in the world after capturing her third consecutive world championship title. In December, at California’s Pismo Beach, Feige won gold in her division of the ISA World Para Surfing Championship. She credits the hours spent at Kits Pool improving her duck dives and paddling as one big reason for her adaptive surfing success, along with months of training she was able to do last fall in Hawaii.

“I’m honoured and stoked to win my third consecutive world title in adaptive surfing,” says Feige, who learned to surf in Tofino before her injury. “I’ve moved from Vancouver to the North Shore of Oahu to focus on my sport, and I’m excited to progress my surfing. Looking forward to the next competition!”

Besides being an outstanding surfer, Victoria is also believed to be North America’s first clinical physiotherapist who uses a wheelchair.

There’s been discussion about para surfing being added to the 2028 Paralympic Games in Los Angeles, following in the footsteps of surfing, which made its Olympic debut in Tokyo in 2020. It would be amazing to see Feige capture gold for Canada.

Are you an SCI BC peer with something to shout about? Or do you know a peer who has recently achieved something noteworthy? Send the details to thespin@sci-bc.ca.

Peer Shoutouts

Kudos to SCI BC peer and Chairstuff owner **STEVE MILUM** for taking his customer service commitment to the next level with the addition of a new Community & Education section to the company’s website at chairstuff.com.

Visitors to chairstuff.com can now find excellent information on virtually every aspect of their bowel and bladder routines. There’s written guides on a variety of topics, along with excellent videos of offering instruction and advice from other peers.

The carefully-sourced information is broken down into four main areas: Self-Catheterization, Bowel Routines, Foley Catheters and Condom Catheters.

“This new section of our website is a great way to offer even more support to our community,” says Milum. “A lot of the focus was on presenting information for people who are newly injured—we know this can be overwhelming in the beginning.”

Chairstuff has been providing BC peers with specialized bowel and bladder supplies for more than a decade, and judging from the comments on the testimonial section of the company website, they’ve been doing an amazing job. And we’re proud to say that Chairstuff has also been a Spinal Cord Injury BC sponsor since 2019. Check out their advertisement on the back cover of this issue of *The Spin*.



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The Weakest Link

Recent research from the University of Pittsburgh confirms that casters are the most vulnerable components of your wheelchair.

Many wheelchair casters simply aren't designed and constructed with enough strength and durability to stand up to daily use, according to research published last year.

This news likely won't come as a surprise to many readers who have had their own experiences with caster disaster—little wheels causing big problems that range from bumps and bruises to costly repairs and lengthy periods waiting for their rides to be repaired. But what might be a surprise is how widespread the problem is.

It's true that casters have a difficult job. By necessity, they have to be small, which in itself limits their strength, and their pivoting function also introduces weak points in their design. All of this

means they have nowhere near the strength and durability of your ride's main wheels when it comes to absorbing the impact of the countless bumps, curbs, rocks and other obstacles you encounter in your daily life. But after analyzing this new research, we believe it's clear that casters can be designed and built better.

The study was conducted at the University of Pittsburgh's Rehabilitation Engineering Research Center on Improving Health and Function Through Use of Performance Standards in Wheelchair Selection. (Thankfully, there is no acronym for this slightly unwieldy name.) The researchers pored through data from the Wheelchair Repair Registry (WRR), a national US database of mobility device failures and repairs, specifically looking at wheelchair caster failures across sev-

eral wheelchair types and manufacturers. Their results were published in an article titled *Community-based wheelchair caster failures call for improvements in quality and increased frequency of preventative maintenance* in the journal *Spinal Cord*, August 19, 2021.

Wheelchair models were sorted into two main groups: manual wheelchairs and power wheelchairs. These were then subdivided into five model types based on user needs for seat functions and supports, and for manoeuvrability over different terrain (see sidebar on the facing page for model types).

Failures were categorized as either high-risk or low risk. High-risk failures had the potential for damage to the wheelchair and risk of injury for the user, and included caster wheel fractures and

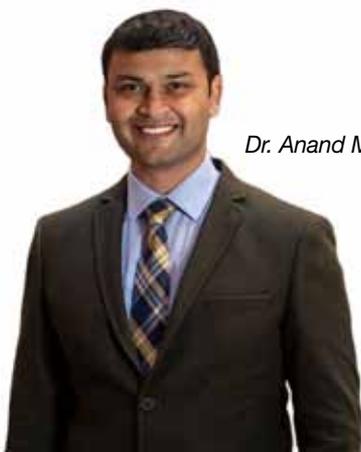
bent parts. Low risk failures included bearing failure and worn-out tires, which have less potential for further equipment damage or personal injury.

The researchers determined the total number of failures, and then broke this down by the failure types and the number of failures for each model type. They found that, between January 2017 and October 2019, the WRR had 6,470 total caster failure entries, which confirmed earlier research demonstrating that these types of breakdowns represent more than a quarter of all wheelchair failures. Of the high-risk caster failures, most occurred in just one to two years of wheelchair use across model types.

“These study findings call for urgent improvements in caster quality,” wrote the authors in the published study, adding that standardization of caster quality would help bring about this change. In fact, the authors, along with other University of Pittsburgh colleagues, are leading development of this standardization. They have built a caster testing machine for the International Society of Wheelchair Professionals (ISWP) and developed the ISO 7176-32 Caster Standard to improve caster quality and prevent high-risk failures and adverse consequences.

“Adoption of the ISO 7176-32 by the FDA and other national bodies will further enforce caster standard testing and quality improvement,” says the study’s lead author, Dr. Anand Mhatre, an assistant professor at the University of Pittsburgh’s Department of Rehabilitation Science & Technology.

Additionally, the study revealed that some manufacturers’ wheelchairs clearly had significantly more failures than those of other manufacturers. Not only



Dr. Anand Mhatre

Wheelchair Types Included In the Caster Study

Manual Wheelchairs

- Tilt-in-space wheelchairs for less active users that require customized seating and positioning support and who may be dependent on caregivers to push the wheelchair
- Ultralight wheelchairs for users who actively self-propel both indoors and outdoors.

Power Wheelchairs

- Models with minimal power seat function and limited use on uneven surfaces
- Models with some power seat functions and frequent use on uneven surfaces
- Models with maximal power seat function and manoeuvrability on outdoor terrain.

that, higher failure rates were seen in specific models. However, all manufacturers were anonymized in the published study, so it’s impossible for consumers to benefit from this finding. It does, however, clearly illustrate that not all casters are built the same, adding to the rationale for clear industry standards.

While it might benefit stakeholders—particular end users—to know which manufacturers are doing a good job and which are not, Mhatre says that it would be counterproductive in terms of the effort to have widespread adoption of standards for caster construction.

“Given how research on failures is positioned—capabilities versus limitations and our ongoing work with manufacturers—we don’t see the benefit in disclosing manufacturers,” he explains. “Our testing facility provides testing services to manufacturers who plan to improve caster quality or test new designs. Other developments in areas of maintenance, selection, and user training can prevent the high-risk failures. More importantly, I would like to join hands with manufacturers and stakeholders to improve user safety and device experience.”

Breaking down the various categories, wheelchair models which were used by people with more complex needs and seating support were more likely to experience high-risk caster failure. For manual wheelchairs, tilt-in-space wheelchairs had nearly double the percentage of high-risk failures compared to ultralight wheelchairs. For power wheelchairs, high-risk failures for the most complex models were 36 percent higher than the most basic models.

“These trends suggest that users who require a higher level of seating support and have complex rehabilitation needs are at a greater risk of experiencing caster failures that can cause user injury and other adverse consequences,” wrote the authors.

On a positive note, the researchers were able to determine that regular preventative maintenance decreased incidence of high-risk failures. They also wrote that they believe that maximizing the wheelchair skills of the users, such as how to best negotiate curbs and road bumps, may prolong the life of casters.

“User education on skills and maintenance can prolong the survival of casters and wheelchair parts and prevent failures,” they wrote.

Besides upgrading your maintenance and wheeling skills, and avoiding terrain or harsh conditions that your wheelchair isn’t designed for, what else can you do to avoid caster disaster?

We suggest playing an active role when you’re seeking a prescription for or buying a new wheelchair. Make sure your occupational therapist or mobility provider is up to speed when it comes to caster problems, and ask them to recommend models offering the most reliable casters. Learn to do preventative maintenance if you’re capable, or ask your mobility provider to inspect and service casters during other repairs. And if you do have a caster disaster, consider asking your mobility provider if there are better, stronger aftermarket products available for your ride instead of replacing the same casters that originally came with it. ■



With his recently-won pro card, Kamloops bodybuilder Tory Jones is looking forward to succeeding at the highest level of the sport in this year’s iconic Olympia competition.

We love it when we see SCI peers challenging conventions when it comes to disability and sport. Tory Jones is one of those pushing those limits—literally and figuratively.

Jones, who was born and raised in Kamloops, has always been a strong guy, but when he fell in love with bodybuilding about seven years ago, he began to take his strength to new levels. The certified tree arborist began to hit the gym with increasing frequency, and in November of 2017, he competed in his first bodybuilding show. He didn’t finish on the podium, but the experience ignited a passion for a sport that’s known for both its physical and mental toughness.

“I was always athletic and strong as a kid and growing up,” says Jones, who is 32. “But it wasn’t until 2014 that I started to take bodybuilding more seriously—that’s when I started to really put on size. Regardless of my placing, I looked at that first show as a stepping stone. It was definitely a great experience and made me realize the things I needed to work harder on.”



Jones' aspirations were derailed in the summer of 2019, when he sustained an T-12 incomplete injury in a car wreck.

"I was taking a couple years off to put on some size, and planned to step back on stage the year I broke my back," he says. "Unfortunately, life had other plans for me."

SCI, however, didn't change his desire to lift and bodybuild.

"I never gave up my hopes of competing. After hospital, while I was in GF Strong in Vancouver, I was already reaching out to other wheelchair users who competed in body building."

In fact, he entered a bench press competition in his home town of Kamloops just after completing his rehab stint at GF Strong. With his hospital bracelet still on, he bench pressed 315 pounds.

Shortly after, he was contacted by Edmonton's TNT Muscle Showdown. The organizers wanted to know if he was interested in participating in the wheelchair class of the 2020 event. Jones agreed. But as we all know, everything changed a few months later.

"Unfortunately, COVID put a halt to the TNT Muscle Showdown," he says. "But that gave me some more time to work on the size that I had lost while I was recovering in Vancouver."

He worked hard throughout 2020 and 2021 with a single goal: compete and win in the qualifying for the Toronto Pro Show, scheduled for December 4, 2021. A victory would give him a coveted IFBB (International Federation of Bodybuilding and Fitness) pro card, which would allow him to compete in virtually any wheelchair bodybuilding event around the world, and make him only the second Canadian man to hold the pro designation (Edmonton's Jack McCann is the other).

More importantly, it would guarantee him a berth in the 2022 version of bodybuilding's most prestigious event, the

Olympia competition, held annually since 1965 in honour of the late Joe Weider, the famous Canadian bodybuilder who is recognized as the father of modern bodybuilding.

"I ended up winning my pro card by competing against other wheelchair competitors," says Jones. "The following day, I competed in the pro show and won that by default, because no other pros were there."

Today, he has a new single goal in mind.

"After Toronto, I continued to train consistently. I'm trying to add size for Olympia, which is the highest level show in the world. The goal is to crack the top five in the world."

He'll continue juggling training with his family life—he and his wife Chelsea have a son and daughter—and his work.

"As for body building paying the bills, no, it does not—although there is prize money to be won," he says. "So I'll continue to work full time as well as train. I have been back on the job for over a year now, in the management side of the company I work for."

If it sounds like a gruelling schedule, Jones says it is—but he wouldn't have it any other way.

"Bodybuilding is just something I fell in love with," he says. "There are no rules. And you're always striving to be bigger and better than you were before. It's always really rewarding during prep to see how much progress you have made. Like any sport, it's definitely personal preference. The training and strengthening of your body is always beneficial. I definitely always encourage anyone with an SCI to add the gym into their lifestyle." ■

Learn more about wheelchair bodybuilding at wheelchairbodybuilding.com.

Reach the Beach

(or any other destination that's at the end of a long, hard trail)



In the space of just two years, Christian Bagg's Bowhead Reach electric aMTB has become an international success story.



To say that Cole Bernier likes his Bowhead Reach would be like describing the Rocky Mountains as pretty good sized hills.

“The Reach for me is literally everything—it’s how I express myself, it’s an accessibility tool, it allows me to take my dog for walks, it’s a source for me to be able to go and blow off steam when I’m having a bad day or the icing on the cake when I’m having a great day,” says Bernier, a 28-year-old from Kelowna who was injured on the job (L1/T12) in 2015. “The thrill it provides me and the speed it’s capable of carrying me down a DH (downhill) run can’t be compared to any other adaptive bike that I’ve seen to date. Most of the time I’m chomping at my (able bodied) riding buddies’ rear tires, which isn’t really something you’d expect to be able to do on an adaptive bike.”

In fact, Bernier (that’s him in the photos above and to the left) is so fast on his “Bowshred” that he won two legs of the aMTB division of the prestigious 2021 Dunbar Summer Series of downhill mountain bike racing. The three race event, which took place at three Rocky Mountain locations, marked the first time aMTB, or adaptive mountain biking, was included as a series category.

But Bernier makes it clear: Bowhead is much more than a racing bike.

“To me, that is the coolest thing about the Reach. You have athletes who are

breaking ground and racing DH races where they’ve never been able to before, but then you also have your average person that just wants to get out and go for a hike with their family. Both of these applications, and everything in between, are so important, as everyone expresses themselves differently and values different things in life. So to be able to just hop on a piece of equipment and go and ride whatever it is you feel that day is pretty unreal, if you ask me. It really is the most versatile piece of adaptive equipment available to us today.”

If you’re thinking Bernier might be a great sales or spokesperson for Bowhead, the company’s founder, Christian Bagg, thought so as well—he hired Bernier last July as Customer Experience Coordinator.

“I manage tech support, parts ordering, and customer info intake for new builds,” says Bernier. “I’m also fortunate enough to help with product testing and development. Honestly, Bowhead has provided me with my dream job. I get to work alongside some of the most amazing people within our company, but also the most amazing and inspiring clientele on the planet.”

BOWHEAD: A BRIEF HISTORY

Most likely, many readers already know of Bagg and his Bowhead Reach. After all, the Calgarian and his revolutionary invention have been featured in almost every mountain biking magazine and website, countless newspapers, and many TV news segments around the world. But just in case you missed it, here’s a quick recap of the Bowhead story.

When he was injured in a snowboarding accident back in 1996, Bagg was two years into an apprenticeship as a machinist. After his injury, he was soon tinkering in his workshop, and mobility devices became his focus. He couldn’t find a manual wheelchair that truly fitted his 6’4” frame, so he built his own. That led to a collaboration with Toronto Paralympian Jeff Adams—the duo created two manual wheelchair companies, Marvel and ICON.

But what Bagg really enjoyed doing was finding ways to get into the backcountry—not easy when you’re a T7-9 paraplegic. Cross country skiing was his favourite outlet, but he discovered that the problem with sit ski frames was their instability when traversing sideways across a slope—the entire frame tilted at the same angle as the slope, and he had to lean up to avoid tipping over, putting him in an awkward position to steer or pole.

Bagg solved the problem by developing a pivoting, or articulating, frame. The design allowed one ski to drop and the other one to rise to match a side slope of up to 30 degrees, while allowing him to remain stable and vertical in his seat bucket. It was a complete success—so much so that he was inspired to apply the design to an off-road handcycle he’d also been working on in his spare time. All of a sudden, he found that he could be stable on side slopes—and lean into corners at high speeds.

Thus began Bagg’s seven-year journey to create Bowhead Corporation and its flagship model, the Bowhead Reach.

Initial prototypes were pure mountain bikes, powered solely by arm cranks. Bagg began building them for customers out of the basement of his Calgary home. When one customer requested an electric motor, Bagg balked—as a cycling purist, he thought this would compromise his invention. Eventually, he relented—and when he tried it himself, he was immediately hooked.

“It was pretty clear the moment right after putting the motor on and riding it—I realized that I’d really been missing out the whole time,” says Bagg. “This was way more fun, and answered the question, ‘How do you get back up the hill so you can go down?’ Well, you need the motor. The motor really gave me that freedom to not be reliant on anybody; to go out on my own. It was freedom, and that’s what the motor started to represent.”

He threw himself into refining the concept, and what emerged was the Bowhead Reach.



BEAUTY AND BEAST

The Reach looks nothing like any other handcycle or aMTB ever built. At the front, there are two 20-inch BMX rims with knobby tires that are steered with a regular bike handlebar. Supporting the two front wheels is Bowhead's secret sauce—the articulating front end made up of two shock-loaded parallelogram frame sections. At the back is a massive, fat 26-inch drive wheel. In between is the scoop seat, a powerful electric bike engine, the battery compartments, and handlebars with throttle and levers for the bike's disc brakes. Sitting still, it looks rugged and refined at the same time.

Early users of the Reach were quick to push the limits. Videos appeared of riders hurtling down single track trails (it's only as wide as a standard set of mountain bike handlebars) and getting big air. And that's when the buzz started.

"I didn't even realize this was a thing," recalls Bagg. "For me, the Eureka! of just

being able to go out on a trail seemed to satisfy me. I thought that was a big enough deal. But here were these people with a fresher idea in their mind of what they wanted to do, based on the life they came from, and I think it just seemed natural to them that it would jump. They looked at it. They sat on it. It rolled



TOP OF PAGE: The original Bowhead Reach Adventure. ABOVE: The new Bowhead RX. FACING PAGE: Bowhead founder Christian Bagg (left) and staff member Cole Bernier assemble a new RX in the company's Calgary manufacturing facility.

down mountains. It rolled over dirt. Why wouldn't it roll over a jump?"

As interest grew, so did Bagg's company. Dean Miller, an engineer from Michigan who Bagg knew from his days when both worked in the mobility equipment field, came aboard and took on the role of President and CEO, allowing Bagg the freedom to focus on advancing the design as the company's Chief Technology Officer. Recognizing that the USA would be a far larger market, a manufacturing and distribution centre was established in Michigan, while design and assembly continued in Calgary. Meanwhile, staff were hired to meet the growing demand.

During this time, two variations of the original version were developed. The Bowhead AWD Adventure-E Bike features an electric motor for each of the three wheels. While the weight of the motors and additional batteries makes this version less nimble and fast, its tremendous torque makes it great for climbing and crawling. And the Bowhead Trailblazer Adventure-E Bike features a set of rear mounted controls, allowing a hiker on foot to operate the bike for someone with an injury level of disability that prevents them from using it independently.

As for riders with higher injuries, Bagg has been committed to getting them on the Reach since the outset. He's developed both specialized throttle and brake controls that can be safely operated using wrist flexors by those with limited dexterity and hand strength. And

for those with limited trunk strength, he's also developed an elastic tensioning system for the articulating front suspension that helps keep the user vertical before, during and after negotiating a sidehill.

"A quarter of our riders are quadriplegics," he explains. "They committed a bunch of money to get a bike, with a commitment from us that we would try to make it work well for them. So it makes sense that we listen to them and try to make it a better experience for them."

As sales continued to climb, Bagg realized that research and development had to continue, and he and his small team of engineers worked on a more refined version of the initial model. As this issue is being prepared, the company is in the process of rolling out its new model—the Bowhead RX Adventure-E Bike.

Unlike the original electric-only Reach, the RX is a true e-bike—it has hand cranks for cycling purists, while a powerful electric torque-sensing motor

kicks in when needed or desired to augment arm-only power by three and a half times. It's the best of both worlds—the RX can be used as a fitness machine, satisfying a requirement for many funding agencies in the US, but it remains a nimble downhill sprinter. Other features include a motocross-style single pivot swing arm back suspension, and 12-speed electronic shifting.

The hand cranks present some challenges in terms of being able to provide adaptive throttle and braking controls suitable for quadriplegics, but the company is making good progress with this.

STICKER SHOCK

When you search online for reviews about Bowhead Reach, you'll find plenty. And what you'll find is that most reviewers are just like Bernier—they don't just like it, they rave about it.

The only thing that's a stumbling block for some is the price. The base model of

the Reach is about \$21,000 CDN, and options like titanium and carbon fibre frame upgrades can raise that significantly. The RX, meanwhile, with its true e-bike features, will cost about \$1,500 more. Bagg concedes the price tag is steep for many individuals aspiring to own their own Bowhead. But he defends the price by explaining that the Reach uses about 140 unique parts that have to be fabricated on a small scale by Bowhead and several partner companies. Add in welding, machining, assembly, hydraulics, wiring, battery cells and everything else, and the cost climbs quickly—particularly in a climate of supply chain woes.

However, he says it's a priority to develop a more affordable basic model, providing he can ensure the experience, along with safety, aren't diminished in the process.

In the interim, Bagg and Bowhead are committed to exploring a multitude of ways to get people into a Reach or RX without breaking the bank. He's happy to help would-be buyers secure assistance from funding organizations. And he's a big fan of facilities, organizations, and provincial and national parks buying one or more and making them available to visitors and guests (currently, you can rent a Reach from CRIS Adaptive in Kelowna or Kootenay Adaptive Sport Association in the Kootenays).

"When people do get in touch with us, and are frustrated about the price, we don't just tell them, 'Well, that's the world we live in.' We ask them, 'Where do you live? What's your situation? Are there funding organizations nearby? Can we help you get in touch with them?' I feel for these people. They want what I wanted when we started this company—just to go outside to have some fun. We want everyone to have those experiences. So that's how we're tackling the cost issue—using other people's money when we can, and making (a lower cost version) an engineering priority."

If you'd like to learn more, there are countless news stories, reviews and videos to be found online, but a good place to start might be bowheadcorp.com. ■



Take a Deep Breath

Learning ancient breath control techniques like yoga pranayama might help you prepare for an encounter with Omicron—and provide you with a number of other health benefits in the process.

More and more, it seems as though we're all going to have to get used to the idea of living with Omicron,

and no doubt other variants of COVID-19 that emerge, for a while—maybe even permanently. Indeed, governments here in Canada and around the globe are signalling that a return to some kind of unrestricted normalcy is imminent (although not everyone is happy about this, given the ongoing risk Omicron poses to those who are clinically vulnerable).

This increasing resignation about COVID-19 seems to be leading many of us to accept the idea that, if we haven't already, and even though we don't want it, we're likely going to get it. But the science remains clear: the vaccines and boosters are making a huge difference in terms reducing the severity of the disease and preventing deaths, and so they remain the most effective line of defence.

The question is, what else can we do to prepare for an infection that many are increasingly seeing as inevitable, despite our best efforts to avoid exposure to it via social distancing and masking up?

Perhaps one of the easiest and most effective things you can do as a person with SCI is to improve your lung capacity and strength.

Like other COVID-19 variants, Omicron's nastiest work is done in the lungs. The majority of people with SCI above the lumbar area already have compromised breathing capacity, which gets worse as the level and completeness of the injury go up—those with complete quadriplegia are the greatest risk. When your breathing capacity is compromised, so too is your ability to cough—a vital function for removing mucous and disrupting viruses and bacteria attempting to set up camp in your lungs. Compromised breathing also means a lowered ability to satisfy your body's needs for oxygen, which is particularly vital when your body is attempting to ramp up its immune response.



So how can you increase your lung capacity and strength? There are obvious answers. One is to quit smoking. Another is to get regular aerobic exercise—exercise that increases your heart and breathing rate. But for many people with SCI, particularly those who are quadriplegic and therefore at the highest risk, getting high intensity aerobic exercise is often difficult and even impossible.

For these readers, there's a great alternative: introducing some breath control exercises into our daily routine. These techniques are surprisingly easy to learn and habitualize. They can be done by almost all people with SCI, with the obvious exception being people who rely on ventilators. And if expanding your lung capacity isn't enough, these techniques bring with them a number of other significant and scientifically-validated benefits for people with SCI.

AN ANCIENT CONCEPT

The origins of breath control exercises can be found in many ancient mind-body exercise disciplines that have been practised throughout Asia for 5,000 years or more. The most widely known of these are yoga, tai chi, and qigong. Yoga, developed in India, involves a combination of muscular exercises, poses and mindful mental focus. Tai chi and qigong were both developed in China, and focus on graceful, dance-like body movements and meditation. Although these disciplines are all different, they all have one thing in common: conscious breath control that improves lung capacity and other aspects of physical and mental health.

For the purposes of this story, we'll focus on yoga. Of the disciplines we mentioned above, yoga seems to be more easily adapted for use by people with SCI—particularly as a way of improving lung capacity, as it's the only one that specifically emphasizes breathing exercises carried out while seated or lying down, without exercising or moving other parts of the body.

That's right—yoga has many more components than just holding "asana" poses like the Downward Dog. One of

them is yogic breathing, or pranayama as it's known in Sanskrit. It mainly focuses on strengthening belly breathing using the diaphragm—a large dome-shaped muscle located between lungs and your belly that moves up and down when you breathe, allowing air to pass through into your lungs. There are other muscles involved in breathing—abdominal and intercostal muscles between ribs. But those most at risk from COVID-19 and other pulmonary diseases are people with quadriplegia, and for these individuals, the diaphragm is likely their only breathing muscle that isn't paralyzed (unless, of course, the injury is C3 or above, in which case ventilator use is mandatory).

Thus, strengthening the diaphragm via breath control exercise must be a good thing.

If you're wondering how you can consciously control your breath, remember that breathing is not an autonomic function such as blood pressure control. Breathing is an automatic function—that is, it works automatically when you're asleep, and even when you're awake and not thinking specifically about breathing. But when you're conscious, you can alter and even stop your breathing—to speak, to smell, to hold your breath underwater—for short periods of time. You can even speed up your breathing, which is called hyperventilation. And you can also modify your breathing patterns, which is what you do during breath control exercises.

Here's a simple yogic breathing exercise to illustrate what we're talking about it. It's called kumbhaka pranayama, which translates to breath retention in English. It can be done from a relaxed sitting or prone position. Inhale as fully as you can through your nose at a normal pace. Hold your breath for 5 to 10 seconds, and then inhale a bit more, and then exhale through your nose. Why can you inhale more? Holding your initial breath increases pressure inside the lungs and gives them time to fully expand, increasing their capacity. Repeating this exercise over time will increase your capacity and the volume of air you're able to draw in,

resulting in more vital oxygen in your bloodstream—and more power should you need to cough up phlegm.

In the sidebar below, our own local adaptive yoga expert, Vancouver peer Mary-Jo Fetterly, describes how yogic breathing has benefited her, and introduces readers to a few other simple and effective yogic breathing exercises.

WHAT THE SCIENCE SAYS

Readers of *The Spin* know that we pride ourselves on following the science. Ideally, we'd like to be able to tell you all about a recent study that definitively concludes that people with SCI who regularly employ yogic breathing exercises have statistically better outcomes after contracting COVID-19. In a world that is still scrambling to understand the impact of COVID-19 on mainstream populations, such a study has not been completed, and may never be.

But there's no shortage of credible studies that clearly demonstrate how yogic breathing improves lung capacity in the general population. In fact, we even found one study that evaluated yogic breathing in people with SCI—*Effect Of Pranayama (Yogic Breathing) On Lung Function In Traumatic Thoracic Spinal Cord Injury Patients: An Interventional Study*, which appeared in a 2015 issue of the *Journal of Physiotherapy*. This study concluded that "inclusion of pranayama in the rehabilitation of spinal cord injury patients can improve lung function... regular practice of pranayama helps to improve lung function, and became an alternative to aids so it should be included in the rehabilitation program in traumatic spinal cord injury patients with impaired lung functions." In short, it's very difficult to argue that yogic breathing doesn't improve lung capacity and strength.

As for the ability of better lung capacity to help give you a better outcome should you get up close and personal with Omicron, the science is pretty clear, and scientists and doctors have been repeating this since the onset of the pandemic. Dr. Robert Eitches, an allergist and immunologist at Cedars-

Sinai Medical Center in Los Angeles, summed it up when he recently told CNN that improving your lung capacity prior to contracting COVID-19 would mean “you would be less likely to hit a critically low lung function state, which would in turn cause you to not be able to oxygenate your blood.” The other in-

disputable benefit of maximizing your lung capacity before you get COVID-19 is that you will be better able to clear excess mucous that builds in your lungs as result of inflammation, becoming a breeding ground for more infection and blocking oxygen from being able to be readily absorbed into your blood stream.

OTHER BENEFITS

We told you on the previous page that, in addition to improving your lung capacity and strength, regular yogic breathing can provide many other science-backed benefits for people with SCI.

Yogic breathing decreases stress levels and anxiety. Research in this area



FOR MARY-JO FETTERLY, PRANAYAMA IS LITERALLY A LIFESAVER

“If you can breath, you can do yoga,” says Mary-Jo Fetterly, an accomplished yoga practitioner and teacher who lives in Vancouver. She has relied on yoga before and after her injury, and teaches adaptive and regular yoga classes.

“When I fell skiing in 2004 and completely broke my neck at C-4/5, I used yoga breathing to stay alive on the remote precipice I landed on until help could get to me,” she says. “I then used yoga breathing practises to fully recover my health, lungs and diaphragm capacity. I have never had a lung infection in the course of my 18-year post-injury life. I do breathing and yoga almost every day, and I use a few different pranayams regularly to maintain my good lung health.”

Fetterly explains that breath and conscious breathing are the most important pillars in the vast practice of Hatha yoga. “By doing yoga breathing practises and cultivating relaxed breathing in our life, we can access the link between body and mind, balance the nervous system, and transform our mental state and physical health,” she explains.

We asked Fetterly to provide some advice and a starting point for readers—particularly those who are quadriplegic—who are interested in incorporating yogic breathing into their daily lives with the goal of improving their lung capacity and strength.

“The practice of all breath work in yoga is pranayama,” she explains. “It’s based on relaxed or diaphragmatic breathing, and this is the essential place to start. One can then do more technical practises to develop capacity, endurance—for example, alternate nostril breathing (nadi shodan) or fire breath (kaphalabhakti). Here are a few ways that you can practice basic pranayama to first develop the foundations—relaxed breathing and diaphragmatic breathing—and then build your capacity from there.”

- **Relaxed Breathing.** Put yourself in the most comfortable position possible, ideally lying down with your knees up. Place your hands on your belly and begin to shape your breath by taking 10 conscious slow and even breaths. Fill the belly and empty the belly completely attempting to regulate the rhythm of your breath so the inhale and exhale are of equal length. Be effortless, establishing a relaxed equal rhythm. Be present. Repeat as many times as you need to to equalize.

- **Diaphragmatic breathing.** Move your hands up from the belly just slightly to the bottom of your rib cage. Breathe in, filling the belly and letting the rib cage expand fully into your hands and sides. Breathe out completely. Repeat this a number of times, expanding the diaphragm on inhale, and allowing it to contract and release completely on exhale as you sense the belly releasing back toward the spine.

- **Three Stage Yoga Breath.** In the same position, place your hands at the lower belly, using them for reference and feedback. Inhale, first bringing your breath all the way down to the belly and filling it, then filling up the mid chest and diaphragm area, and finally filling up the upper chest. Do this with one inhalation, and then exhale completely, from the upper collarbone/upper chest down to the mid chest, and then out from the belly, pushing the navel back to the spine to empty completely. Repeat this several times. Ideally, you will be able to create a pause at the end of the exhale when the belly is completely empty, before beginning your new inhale.

Before starting these exercises, Fetterly recommends putting on some comfortable clothes. She also suggests to avoid eating beforehand, as food can put pressure on the diaphragm and lungs and make deep breathing more difficult. Setting a time of day and place where you can concentrate entirely on the breathing exercise is also important. She reminds you to always use your nostrils for breathing, although if you have a blockage that prevents you from breathing freely through the nostrils, you can slightly open your mouth to allow better ventilation. Although lying down is preferable, you can do many pranayams while seated in a comfortable position that you can maintain throughout the entire practice. Focus on keeping your spine straight and avoid straining the body.

“Practising conscious breathing daily will change your life,” concludes Fetterly. “It’s the most simple and yet effective tool for overall good health and agency in a world that seems to be out of control. We can’t change the world in an instant, but we can change the way we breathe in an instant, for the better.”

Mary-Jo Fetterly is the inspiration and founder behind Trinity Yoga Inc. a national yoga teacher training, personal development and advanced studies school. You can learn more and contact her at trinityyoga.net and mary-jo.com.

suggests that pranayama somehow calms the nervous system, likely because it improves oxygen uptake. Oxygen is energy for your vital organs, including your brain and nerves.

Yogic breathing seems to improve sleep quality. Research in this area suggests that the reason is that it slows both breathing and heart rate when practised, which may help calm your body for sleep. Other research has found that pranayama also improves sleep quality in people with obstructive sleep apnea.

Yogic breathing increases mindfulness. Most of the time, breathing is automatic; we do it without giving it much thought at all. But during pranayama, you have no choice but to be aware of and focus on your breathing—which means you're focusing on the present moment. This is known as mindfulness, which has been shown to be beneficial for regulating emotion and improving depression. It's speculated that yogic breathing achieves this by removing carbon dioxide and raising oxygen concentration, which fuels brain cells.

Yogic breathing reduces high blood pressure, or hypertension, which increases the risk for some potentially serious health conditions like heart disease and stroke. Again, the active ingredient seems to be that yogic breathing promotes relaxation and decreases the stress response, which is a major risk factor for high blood pressure.

Yogic breathing enhances cognitive performance and improved brain function, including your working memory, auditory memory, sensory-motor performance, cognitive flexibility, and reasoning skills. Again, these benefits are linked to the stress-lowering effects of pranayama. The increased oxygen uptake, which energizes brain cells, likely plays a role as well.

YOGA: THE BIG PICTURE

We've attempted to provide you with some basic information on the benefits of yogic breathing and introduce you to some techniques that might help you be better prepared should you contract COVID-19. But yoga, and other ancient disciplines like qigong that also embrace breath control, involve and encompass so much more. In a way, teaching some yogic breath exercises is like teaching someone the chords of C, D and G on a guitar—this might allow someone to play the simplest of songs, but there's a vast world of music out there far beyond three chords.

Nevertheless, learning the chords of C, D and G might inspire some people to do more than just scratch the surface of music. It may be the same for some who take the time to learn some simple yogic breathing techniques—the improvements they see may inspire them to immerse themselves more fully in the discipline, and discover many more benefits, or increases in the beneficial effects, including better fitness and a more relaxed and wholesome lifestyle. Practitioners and teachers like Mary-Jo Fetterly have discovered and proved that the majority of yoga elements and practices can be adapted for people with SCI and other disabilities—and that they may be among those most likely to benefit from incorporating yoga into their daily lives. ■



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Resistance to Change

Surveys demonstrate that the majority of people with SCI are really dissatisfied with their bowel routine—but despite that, most have not attempted to change it. New research provides some clues about the reasons for this.

In the Winter 2017 issue of *The Spin*, we told you about research that SFU and ICORD scientist Dr. Victoria Claydon and colleagues had conducted to gain some insight about the challenges people with SCI face with bowel care. Their survey, which recruited 287 individuals with SCI, produced some eye-opening results.

The first surprise was how many were dissatisfied with their bowel program. About 78 percent were unhappy with it, noting that it interfered with relationships, impacted their jobs, triggered autonomic dysreflexia (AD), and was a drain on their time and resources. But there was another surprise in the data.

“Having researched AD after SCI for quite some time, we appreciated how difficult and complex bowel care can be,” says Claydon, who is a professor at SFU’s Department of Biomedical Physiology and Kinesiology. “However, we were surprised at how many people were not changing their bowel care despite being very dissatisfied with it—about 71 percent of participants had not made any changes to their bowel care routines for at least five years. This raised an important question: why aren’t people changing their bowel care if they are so dissatisfied with it? We wanted to better understand what was going on here.”

To address this question, Claydon and her team partnered with local SCI physicians and nurses, Dr. Heather Gainforth from the Applied Behaviour Change research group at UBC’s Okanagan campus, and Spinal Cord Injury BC (we helped with the project design, developing interview questions, and recruiting the study’s 13 participants).

“We conducted a series of interviews to follow up on our survey results, asking people living with SCI in BC about the barriers and the facilitators to changing their bowel care routines to optimize their care,” says Claydon. “We made sure that these individuals lived across

the province, with diverse consideration for geography, age, sex, and level and severity of SCI. Since we heard a lot of common themes across these interviews, we believe that we have had a comprehensive look at this question.”

The results were published in a paper titled *Barriers and facilitators to changing bowel care practices after spinal cord injury: a Theoretical Domains Framework approach* in the January 7 issue of the journal *Spinal Cord*.

“Our findings identified seven main themes that impact the ability to change bowel care,” explains Claydon. “These themes capture both the barriers—what makes it hard—and facilitators—what makes it easy—to change bowel care routines. Some of our interview respondents had success over the years in achieving a bowel care routine that worked for them and that they are satisfied with. Some were frustrated and still felt their care was not ideal. By talking about what helps and what hinders changing bowel care, we were able to get an in-depth understanding of this complex issue.”

The seven themes are outlined in the sidebar below.

“Which ones are most important for a given individual will likely depend on their individual situation, but now we understand what these factors are, we can start to provide resources to help address them, and that is our ultimate goal,” Claydon says. “We need to expand

Seven Themes of What Helps or Hinders Change

Workplace flexibility. When participants were engaged in a flexible/supportive work environment they felt empowered to make changes.

Opportunity or circumstance. Sometimes optimizing another care routine like bladder care gave people the opportunity to now focus on their bowel care.

Access to resources. A lack of perceived support (physical and financial) was often cited as a barrier to change. When these resources were present, change was facilitated.

Beliefs about consequences of change. Fear that changes might lead to accidents or loss of independence was another barrier to change.

Perceived support. Whether friends, partners and/or caregivers were supportive of changing care routines impacted decisions about making changes.

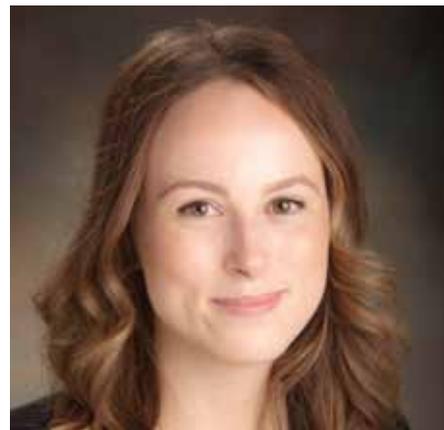
Peer mentorship. Peer mentors were regarded as highly influential when it came to making changes to care routines.

Knowledge of options available. When people aren’t aware of the options, they don’t know what changes are possible. Knowledge of options was viewed as empowering.

the scope of this research to ask health care providers—physiatrists, doctors, nurses, care aids and others—their perspectives on supporting individuals with SCI to change their bowel care. This will enable us to gain a clearer picture about how we can support people with SCI make positive, relevant and feasible changes to their bowel care in order to improve quality of life.”

She adds that these supports might include education on bowel care options (for healthcare professions and people living with SCI), advocating for changes to health care policy, or enhancing existing peer mentorship, support and resources in the context of bowel care.

“Improvements to bowel care have long been a priority for individuals living with SCI,” she says. “It’s time for researchers and clinicians to better recognize the need for improvements to bowel care, and to consider the perspectives of individuals living with SCI regarding the factors that help and hinder making changes to their care routines so that any proposed treat-



Study co-leaders Dr. Victoria Claydon (left) and Dr. Vera-Ellen Lucci

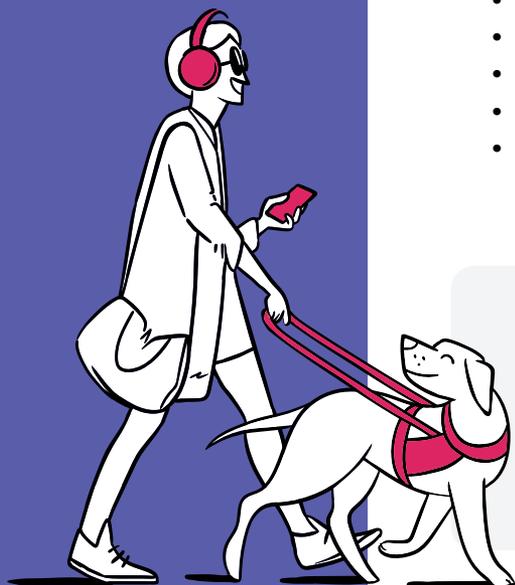
ment modifications or novel therapies are feasible and appropriate for their needs.” She invites any healthcare providers interested in sharing their thoughts about what helps and what hinders them from supporting their patients to make contact via the study’s website (icord.org/studies/2022/01/bowel-care-survey).

As for readers hoping for a better routine, she offers some suggestions.

“I think there are always things that might help with any care routine—

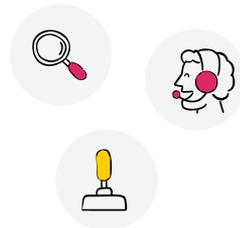
sometimes big things like trying a new method or medication, but sometimes smaller things that can help optimize a current method and improve quality of life,” she says. “A sensible first step might be to talk about your bowel care, perhaps with a trusted family member or friend, an SCI BC peer, or a nurse continence advisor, GP or physiatrist to identify which aspects could be improved and what might be the best approaches for you to try moving forward.” ■

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Speed Matters



In survey after survey, people with SCI report extreme dissatisfaction with the time-consuming steps they have to take to complete their bowel routine. Could the solution be a surgery-free spinal cord stimulation device?

In February, a research group led by Swiss researchers Dr. Jocelyne Bloch and Dr. Grégoire Courtine published results of their STIMO clinical trial in the journal *Nature Medicine*. Three participants with complete SCI were surgically implanted with an array of electrodes. During electrical stimulation, all three regained the ability to independently move their legs during various activities including a walking motion while suspended on a treadmill. Naturally, despite Courtine's cautions that this did not represent in an imminent cure for SCI, the mainstream media enthusiastically embraced it as such.

Overshadowed by this news was the publication of a study by researchers at UCLA. Using an externally-worn device and electrodes that are attached to the skin above the spinal cord in just a few seconds, Dr. Reggie Edgerton and colleagues demonstrated how a simple course of stimulation could restore sensation and induce contractions in the rectum of people with SCI who live with neurogenic bowel dysfunction. They also presented a single case study, in which one participant with SCI used the same system to reduce her bowel routine from 75 minutes to just 15 minutes.

Not surprisingly, this research didn't create anywhere near the same media buzz. This is a shame, of course. It's not that the STIMO trial isn't impressive work—taken in context, it truly is. As Courtine carefully explained, many years down the road, it could be one component of many complementary strategies needed for a breakthrough in restoring all kinds of function, including walking, after SCI. But people with SCI have repeatedly said in survey after survey that neurogenic bowel is a far greater and immediate research priority than not being able to walk. That's why we believe the prospect of a non-surgical, easy-to-use, low-cost, and low-risk device to dramatically improve bowel function for people is really exciting—particularly as widescale approval of the device by bodies like the FDA and Health Canada appears to be imminent.

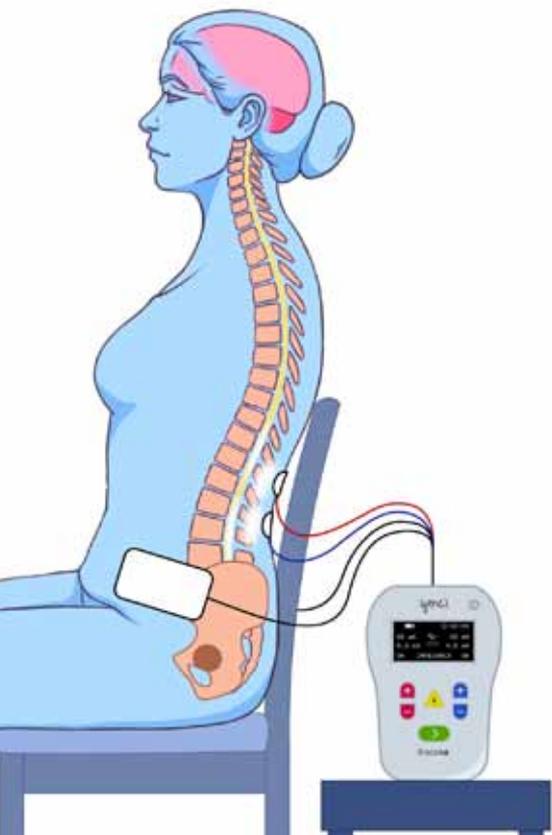
The UCLA researchers' paper, titled *The Effect of Non-invasive Spinal Cord Stimulation on Anorectal Function in Individuals With Spinal Cord Injury: A Case Series*, appeared in the February 17th issue of the journal *Frontiers in Neuroscience*. In the past, we've published several stories about the scientists involved—Dr. Reggie Edgerton,

Dr. Parag Gad, and four other colleagues associated with Edgerton's UCLA laboratory—and their work in exploring the use of surgery-free transcutaneous neurostimulation devices to improve a variety of functions in chronic SCI. Previously, we've written about their work in restoring bladder function for people with SCI, and arm and hand function for people with quadriplegia. You may also recall that, in addition to pursuing research in this area, they've developed their proprietary stimulation device, called SCONE (short for Spinal Cord Neuromodulator), and spun it off into a company called SpineX.

The researchers recruited four participants for this work. Three took part in the acute stimulation component of the study, intended to test the ability of SCONE to restore sensation in the rectum and induce the type of contractions needed for a more normal bowel movement during the time of stimulation. One of these participants was injured at C5, and the other two were injured at T6. The fourth, also injured at T6, was recruited for a single case-study to see if a week-long stimulation training protocol would actually improve her real-world bowel routine.

In the acute component, the participants completely voided their bowel with an enema six hours prior to stimulation. Then, at the time of stimulation, two electrodes were attached to previously-determined target locations on the skin above the spinal cord. A probe was inserted into the rectum to record contractions and test sensation during active (or acute) stimulation. The participants were asked to concentrate on trying to push as if they were attempting a bowel movement at the same time stimulation began. The result? The stimulation generated contractions in all three participants. Additionally, two of the three participants experienced improvements in sensation in the rectum.

“The acute findings demonstrate for the first time that, using a non-invasive approach, we can actually activate deep structures such as the rectum,” says Gad, a bioengineer who co-lead the study. “The active stimulation seems to result in contractions in various regions of the anus and rectum. These are important, as these stim-generated contractions can further assist in a bowel movement.



In short, the stim-induced contraction and voluntary effort work synergistically to assist in bowel movement.”

Also important, says Gad, is some restoration of sensation within the rectum. “Sensation is like an internal GPS system,” he explains. “How do you know how to get to your destination if you don’t know where you are? Once you know where you are via active and accurate sensation, the actual destination—the functional outcome of a bowel movement—can be achieved with certain movements. Finally, sensation also allows the individual living with SCI to understand that they have completed their bowel movement, rather than be second guessing themselves. These are things that most able-bodied people don’t realize or appreciate, since bladder and bowel function are taken for granted.”

The case study is even more intriguing. The participant underwent a week long training regimen with the SCONE device, but was not stimulated during her actual bowel routine. The researchers wanted to see if this type of training would result in real world improvements, as had already been witnessed for restoration of bladder function, and hand/arm function in quadriplegia.

The participant was asked to record the amount of time needed to complete her bowel program. Prior to the study and during the first few days, her bowel program time was consistently approximately 75 minutes. After completing one week of daily stimulation, her bowel program time reduced dramatically to 15 minutes. Then, over the course of the next 18 days, sham stimulation was delivered—that is, she thought she was receiving stimulation during daily training sessions, but she actually wasn’t. During this sham treatment, her bowel program time increased to between 45 and 65 minutes.

“This result shows us that we can normalize bowel movement with a relatively simple intervention such as one hour of spinal neuromodulation,” says Gad. “The sham portion was particularly important, since one of the criticisms of our work

in this area is that there is a placebo effect that we do not account for. In this case, the participant was blinded to the stimulation intensity. It allowed us to assess bowel function with little to no bias from the participant.”

As for the mechanisms behind the team’s success, and the success of others also testing various forms of neurostimulation in SCI, it’s still a fuzzy picture.

“While the mechanism by which neuromodulation achieves these effects remains to be elucidated, we hypothesize that the stimulation signal interacts with neural fibres that remain after an injury to correct or improve end organ function,” says Gad.

Obviously, we wanted to know what’s next for Gad and his colleagues. A top priority is to receive full FDA clearance for SCONE—at the moment, the FDA has approved it for investigational use only.

“Bowel function is an outcome in our upcoming clinical trial to be conducted at seven sites in the USA,” says Gad. “FDA clearance is the main goal for this trial, which will recruit participants with SCI, stroke and MS. Once we receive clearance for the SCONE device, we are hopeful that individuals can use the SCONE device for bladder and bowel function. We anticipate this trial to begin by April. Our current road map targets approval of SCONE by 2023.”

So as early as next year, it may become a reality for people to actually obtain and use a SCONE device for improvements in their bowel routine—and for many other functional improvements.

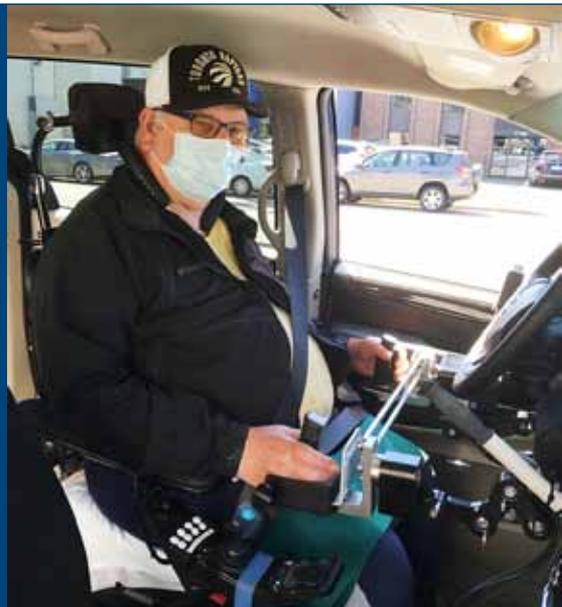
“One key fact that we have now shown that SCONE is the first technology that can impact multiple functions, including hand and arm, trunk, lower extremity, bladder, bowel, breathing, sexual function, sensation, spasticity and head control,” says Gad.

On a side note, Gad and his colleagues are actively working with Dr. Andrei Krassioukov’s ICORD lab to begin bladder, bowel and sexual function research studies in Canada using the SCONE device. We’ll present more information on that as it becomes available. ■

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Mending the Gap

SCI BC is collaborating on a new federally-funded research project that's attempting to develop a "biobridge" to support nerve regrowth across the injured spinal cord.

Many of you might have seen the recent news coverage surrounding our federal government's \$24 million commitment to support a UBC-led project to develop a biomaterial "bridge" to promote spinal cord regeneration across the injury site. The funding, which was announced in January, comes via the federal government's New Frontiers in Research Fund.

What you might be surprised to discover is that SCI BC is an official collaborator on this project, which is titled *Mend the Gap: A Transformative Biomaterials Platform for Spinal Cord Repair*.

At first glance, this might seem to be an unusual project for us to collaborate on, given that we don't typically get involved in this type of early-stage, cure-focused research—for the most part, we've chosen to support research that's primarily intended to quickly bring improvements to the quality of life of British Columbians who live with SCI. But as you'll learn, there are some excellent reasons we chose to be involved in this study.

Mend the Gap is a multi-year project that involves many leading regeneration and biomaterials researchers from across Canada and around the world. These include ICORD Director and UBC professor Dr. Wolfram Tetzlaff, who is

one of the co-leads, along with several other ICORD and UBC principle investigators, including Dr. Brian Kwon, Dr. Dena Shahriari, Dr. John Madden, Dr. Karen Cheung, and Dr. Judy Illes.

Finding breakthroughs for SCI is an incredibly complicated field of research. Yet the problem SCI presents can be simplified into just a few words: spinal neurons, essential for full body functioning, just can't seem to regrow and reconnect across the injury site.

While decades of research have never yielded anything that can remotely be considered a cure, they have given us a great deal of insight and a clearer understanding of the challenges of somehow encouraging or supporting neurons to regenerate and reconnect. Perhaps most importantly, our global SCI research community now recognizes that the injury site is a sort of dead zone of up to two centimetres in length that seems to be extremely hostile to neurons attempting to regrow across it—and that a key to a cure is to somehow make this area support, rather than discourage, nerve regrowth.

Mending this gap has proven to be frustratingly difficult. For example, a great deal of research has been conducted to construct a tiny scaffold or bridge and then surgically insert it

into the injury site. The hope was that these scaffolds would support regrowth by providing nerves with tiny channels through the troublesome scar tissue. Despite many, many attempts and variations of this approach, and millions of dollars of research funding, it has never been successful.

Other attempts have been made to inject gels or liquids into the injury site—but again, despite these seeming to support nerve growth in the petri dish, they have not yielded much in the way of functional success.

Most recently, however, there's been interest and some preliminary forays into a variation of this approach: using a gel that, once injected into the injury site, can be externally modified by magnetics to create microchannels across the gap that are highly receptive to nerve regrowth. And this is the essence of the research at the heart of the *Mend the Gap* project.

"A biomaterials bridge is compatible with other systems and structures in the body and is minimally disruptive,"



explains principal investigator Madden, a UBC professor of electrical and computer engineering. “The soft gel that our team plans to use contains tiny magnetic rods that are aligned using an external magnet, creating guide rails that support the nerve fibres to grow in the right direction, eventually crossing the gap.”

In addition to being able to be magnetically manipulated to create channels that support nerve growth, the gel will also contain compounds that can modify scar tissue to make it more receptive to nerve regrowth, and stimulate nerve fibres to begin that regrowth. It will be precisely injected into the spinal cord by a surgical robot.

The ambitious goal of this project is to be in a position to conduct human clinical trials within six years. The initial focus is repairing the spinal cord in recently injured individuals, but it’s hoped that positive results can also be applied in people who live with chronic SCI.

This is one of the reasons underlying SCI BC’s decision to collaborate on this project. Representing our organization is Executive Director Chris McBride, who, as many readers know, has a PhD in neurosciences.

“What’s particularly impressive about this study is its commitment to consider the needs and perspectives of all stakeholders, including Canadians with SCI,” says McBride. “As someone whose career has straddled both the SCI peer and research communities, I can clearly see the value of having SCI BC be meaningfully involved in this project. The primary funder, along with the members of the scientific community conducting the research, have expressed their deep commitment to ensuring the work is relevant to and continually informs the SCI community. For these reasons, we’re pleased that SCI BC will be involved in knowledge translation and ensuring the perspectives of people with SCI are integral to the project’s work.”

We’ll be sharing news of the project’s process in future issues of *The Spin*. In the interim, you can learn more at the project’s website (mendthegap.ubc.ca). ■

ask the SPIN DOCTOR

Joe in Vancouver writes, “At a recent peer event, I met someone who told me about his experiences with contractures, scaring the daylights out of me in the process. How can I avoid these?” To answer this issue’s question, we reached out to Amrit Dhaliwal, a physiotherapist at GF Strong’s Inpatient SCI Program.



Contractures—the loss of mobility in a joint—are a common complication of SCI. They’re the result of significant spasticity that holds muscles, tendons and ligaments in a shortened position. Over time, the shortened position becomes permanent, restricting movement in the joint. Contractures are often painful, and can limit function and independence. Once a contracture develops, it’s nearly impossible to reverse, and surgery is often required.

It isn’t all doom and gloom, because there’s a great way to manage your spasticity and prevent contractures—a regular stretching program during which you move muscles into their fully-lengthened positions and hold them there.

A simple stretching program is a low-cost intervention that does not require fancy gadgets or gizmos. There is no one-size-fits-all stretching program. Different levels of injuries, ages, and pre-existing injuries will likely result in different stretching needs. It’s important to consult with your doctor, OT and/or PT before starting a stretching routine to prevent injuries such as fractures, and to determine the most appropriate stretches. Some helpful tips to keep in mind are:

- Think about the positions you’re in all day, and seek to incorporate stretches that stretch muscles that have been held in shortened positions—for example, muscles that are in shortened positions when you’re sitting.
- Aim to take your joint to the end of range, and hold it there for a sustained period of time. But don’t overstretch or force a joint past the point of resistance, as this can cause injury.
- Perform movements slowly. Jerky fast movements can cause injury or increase spasticity. If sensation is impaired, watch for signs of pain, such as AD.
- Depending on your abilities, you can do a stretching program yourself, or direct your caregivers to assist with these exercises.
- Every person has their own unique needs—for example, those with minimal spasticity likely need less frequent stretching compared to those who have increased spasticity. Generally, sustained stretches (10 minutes or longer) are thought to be more effective than those of shorter duration. The more frequently you can perform them the better; integrate them into your daily routine where possible (many people have success stretching before getting out of bed in the morning). It’s best to start with performing the stretches for as long as possible and as often as possible. Then slowly reduce this in either frequency or duration of stretches as required.
- Regular monitoring is important as it will be the first clue to alert you if you are maintaining or beginning to lose range in any joints. Regular re-assessment of your range of motion and physical function with a qualified therapist (OT/PT) is advised to monitor for any changes.

A stretching routine is an invaluable part of a fitness program—it can help prevent dreaded contractures, assist in managing spasticity, and prevent pain. Best of all, it’s free. So collaborate with a therapist and find a stretching routine that best suits your individual needs and lifestyle.



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Participate in Research

SCI research is about much more than test tubes, stem cells, and a far-off cure.

At ICORD (International Collaboration On Repair Discoveries), SCI research is also about improving bladder, bowel, and cardiovascular health; taming pain and autonomic dysreflexia; enhancing sexual health and fertility; new assistive technologies; wheelchair design and ergonomics; and much more. In other words, it's about maximizing recovery, independence, health, and quality of life. But it doesn't happen without you. That's why SCI BC and ICORD are partnering to help raise awareness and increase participation in world-leading research. Working together, we can make SCI research more meaningful and move it along at a faster pace, and we invite you to be a part of it.

Effect of Passive Cycling on Cardiac Function and Spasticity

Overview: Using a pedalling device attached to a wheelchair, researchers in Dr. Victoria Claydon's lab are investigating whether passive cycling can improve cardiovascular function following spinal cord injury.

What to expect: Participation involves one testing session that will take approximately 2 hours. Participants will be seated in a wheelchair with their feet secured via straps to the pedalling device. Using non-invasive monitoring equipment, researchers will record blood pressure, heart rate, cerebral blood flow, and breathing parameters. The wheelchair will be placed on a treadmill allowing the device to move your legs in a bicycle motion. This will be done at three speeds, each for 10 minutes, with a five-minute break in between. A short questionnaire will follow the cycling protocol.

Who can participate: You may be able to participate in this study if you are healthy; aged 19-50 years old; have sustained a spinal cord injury; and have received full immunization against COVID-19 according to current Health Canada guidelines. You may not be able to take part in this study if you self-identify as having cardiovascular or neurological disease; are currently taking any cardiovascular acting medications; have active pressure sores or use a ventilator; are pregnant, or think you might be.

Why participate: There are no direct benefits to you from taking part in the study, but the researchers hope that the results of this study will ultimately aid in the rehabilitation and quality of life of people with cardiac disease and/or spinal cord injury.

Location: The study will take place Simon Fraser University (8888 University Drive, Burnaby).

For more information or to sign up to participate: please contact the study coordinator, Michael Ruiz-Peters by email (michael.peters@vch.ca) or phone (604) 379-3453, or visit <https://icord.org/studies/2022/01/passive-cycling>.



Adapted Rowing: SCI Accessible Exercise in the Community

Overview: Led by ICORD researcher Dr. Carolyn Sperry, a team of researchers at SFU, BCIT and UBC are conducting interviews to get feedback about adapted rowing (aROW) and ski (aSKI) ergometers.

What to expect: Participants with prior experience with both the aROW and aSKI will be given the option to have an interview conducted over the phone or using Zoom. Those with no prior experience, or those who prefer to experience the use of the aROW and aSKI in person, will be invited to participate in an in-person interview at the PARC gym. Participants will also be asked to complete two short online questionnaires regarding the usability of these machines. Online interviews will take approximately 45 minutes; in-person interviews will take approximately 60 minutes.

Who can participate: You may be eligible to participate in this study if you use a wheelchair and have varying levels of experience using adapted rowing or ski ergometers and other exercise equipment OR have assisted with an adapted exercise program for people with SCI involving the aROW and/or aSKI; are 16 years of age or older; are able to communicate effectively in English; and are currently (within last 6 months) going to a fitness centre.

Why participate: The main benefit of participating is the potential to contribute to the development of new adaptations that will improve the accessibility of commercially-available rowing and ski ergometers. For online interviews, a \$10 gift card will be provided as a token of appreciation for your time. For in-person interviews, a \$20 gift card will be provided as a token of appreciation.

Location: In person interviews will take place at ICORD/Blusson Spinal Cord Centre (818 West 10th Avenue, Vancouver).

For more information or to sign up to participate: please contact the study coordinator, Abigail Baker, by email (ajbaker5@student.ubc.ca) or call 250-869-7230, or visit <https://icord.org/studies/2021/12/adapted-row-ergs>.



Learn more about what makes ICORD one of the biggest and best SCI research centres in the world, and the research they are doing, by visiting www.icord.org/research/participate-in-a-study

That's Smart!

Looking for home automation inspiration? Check out *Taylor's Smart Home Tour*, the latest YouTube video from Technology for Living.

Taylor Danielson is truly the master of his domain—yet he doesn't need to lift a finger to monitor and control virtually every part of his Langley home.

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Technology for Living, the Vancouver-based non-profit that's committed to helping people with physical disabilities use technology to live independently, showcases all of Danielson's home automation in its latest installment of the WE TALK TECH video series, *Taylor's Smart Home Tour*.

In the video, Danielson, who works for Technology for Living as its Community Coordinator, takes colleagues Wayne Pogue and Ean Price on a virtual tour of his home's smart features.

"It's absolutely intended to be inspirational in nature," says Danielson, who lives with spinal muscular atrophy II. "I hoped to cover a somewhat complete smart home transformation so that people can see what is possible at a high level, and from there they can pick and choose which devices would be best suited for their life."

Danielson's passion for smart home technology started when the first smart speakers hit the market in the mid-2010s.

"This was revolutionary for me. I went from struggling to use remotes, buttons and light switches to using exclusively voice commands. In my own life this has led to a level of independence I haven't had before. I was in control. I've seen many people with diverse abilities who have implemented similar technologies also achieve a renewed level of independence. I would recommend that anyone who has yet to try smart technologies to give it a go! Starting small with some smart light bulbs can be a great introduction."

While Danielson has purchased most of his devices, TIL has helped—for example, his automatic door opener was provided through a TIL initiative that some readers may also qualify for.

"TIL services not only include providing and setting up these devices, but also the extensive experience of a team of biomedical engineering technologists and technicians, who can help an individual find a solution which works well for them," he says.

To watch this video, and other videos in the WE TALK TECH series, search for "Technology for Living" at [youtube.com](https://www.youtube.com). You can also learn more about TIL at [technologyforliving.org](https://www.technologyforliving.org). ■





BC SCI NETWORK

The BC Spinal Cord Injury Network helps make BC the best place for people with physical disabilities to live, work, and be active.

Alison's Journey

A motor vehicle accident in 1987 left Alison a T6-7 paraplegic. "It affects every aspect of daily life," she explains. "Tasks take longer to accomplish, I fatigue more easily and pain is constant. I have to prioritize my activities to find a balance between doing too much vs. not doing enough."

Since 2010, Alison has been a volunteer peer coordinator with Spinal Cord Injury BC (SCI BC). During this time she came across an employment opportunity with the Cariboo Chilcotin Coast Tourism Association (CCCTA) as a Tourism Accessibility Coordinator. The position sounded right up her alley.

Hearing about her interest, SCI BC referred Alison to Neil Squire's Working Together program and she soon landed the job.

"My main goal was to ... share my personal experiences as a person with a disability to educate others and improve accessibility and inclusion in the region where I live," she says. In her role, she does this by supporting tourism business development and marketing activities in the Cariboo Chilcotin Coast, and also conducts accessibility consultations of tourism businesses and experiences.

"I have more confidence in myself and my abilities," says Alison, who is enjoying her position. "I feel like my experiences as a person with a disability have value to others in making positive change in understanding the importance of accessibility and inclusion."

Thanks to the BC SCI Network, this was made possible.

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