



Imagination CENTRE

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Freeing Young Minds

Brain-Computer Interface for Kids



The Tiger in the Cage

Liam loves what most eight-year-old boys love: Lego, video games, and gym class. He also loves math and science, helping others, and he tells the best stories. But few know—because Liam was born with cerebral palsy that makes his muscles lag behind his bone growth which leaves him a quadriplegic. It affects his ability not only to move, but also to communicate. He is a child with the will to engage and the devastating frustration of few ways to participate—in play, in willed movement, in expression of thought.

At the age of two, Liam became an outpatient at the Glenrose Rehabilitation Hospital, where his spirit endeared him to the Pediatric Rehabilitation team. In 2018, Liam's pediatrician, Dr. John Andersen, brought the Glenrose's patient and family-focused clinical expertise to a new alliance with the two other top pediatric rehabilitation teams in the country and revolutionized pediatric rehabilitation in Canada.

Almost overnight, Liam's life changed.



I'm a wild tiger ready
to jump out of the cage

Liam, age 8

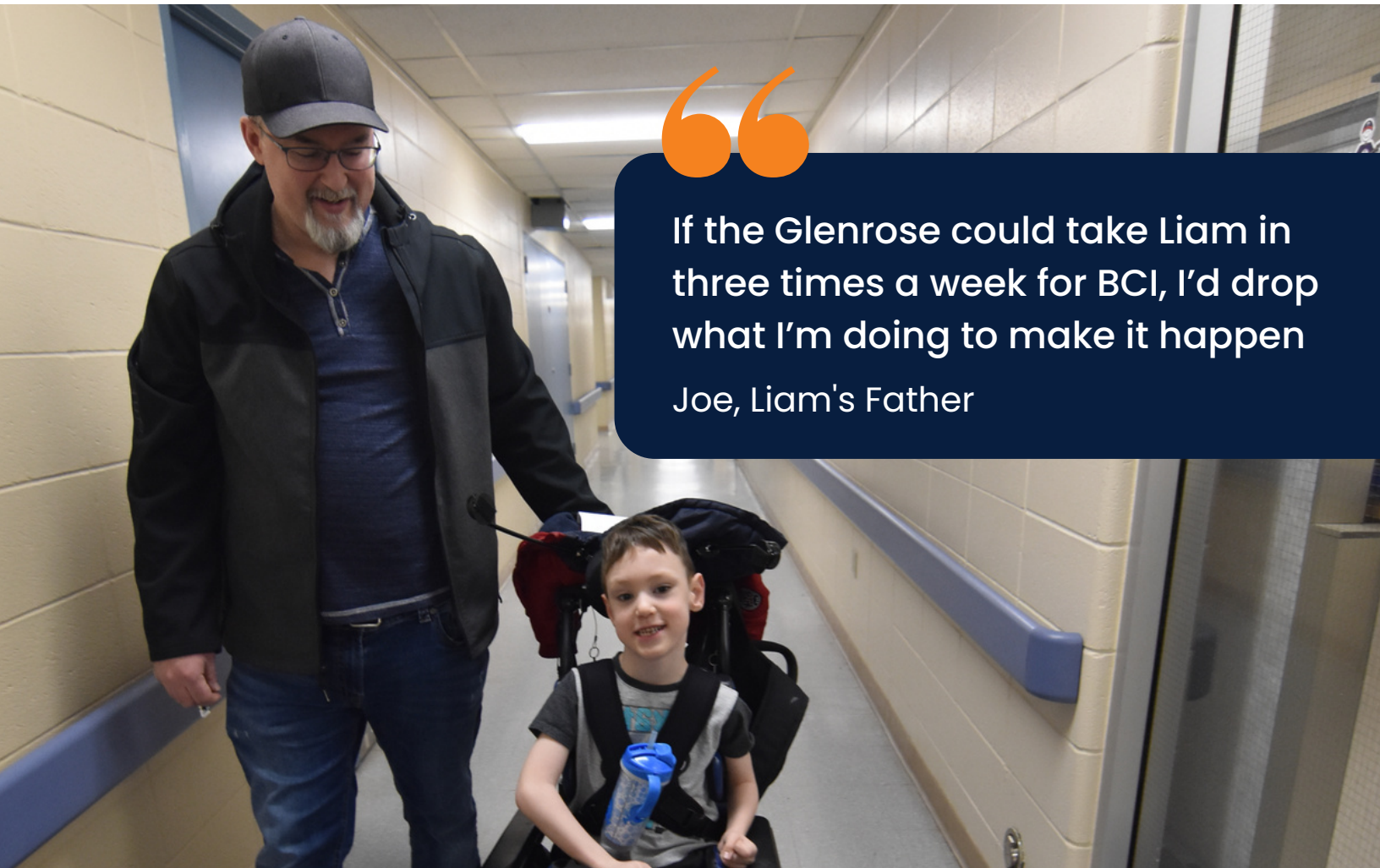
“I’m a wild tiger ready to jump out of the cage,” says Liam, who exudes energy, despite his wheelchair seat, as he anxiously waits for COVID’s grip to relax. He can’t wait to get back to exploring his abilities through his game-changer: Pediatric Brain-Computer Interface therapy and assistive technology (BCI).

Liam especially looks forward to using BCI so he can master and teach his peers Minecraft—a real social connection tool. With an engineer in the room to observe and lend a hand as a clinician guides Liam’s BCI therapy, Liam has found new motivation through gaining, new skills and more control in his life. Already he’s a speed-demon as he maneuvers his own electric wheelchair, and, as his dad reports while Liam beams, “He’s a superstar,” at Edmonton’s Lauderdale Elementary.

“If the Glenrose could take Liam in three times a week for BCI, I’d drop what I’m doing to make it happen,” says Liam’s father, Joe, who’s an independent finishing carpenter.

“Independence, quality of life, happiness—all those things will help Liam progress in his life,” says Joe. Liam and his parents can already see his future as a crane operator, or even the commander of an international fleet of drones.

He’s a tiger in waiting.



If the Glenrose could take Liam in three times a week for BCI, I’d drop what I’m doing to make it happen

Joe, Liam’s Father

What is Brain-Computer Interface (BCI)?



We start with a child like Liam, who has a mind full of great ideas but also has challenges with movement and communication.

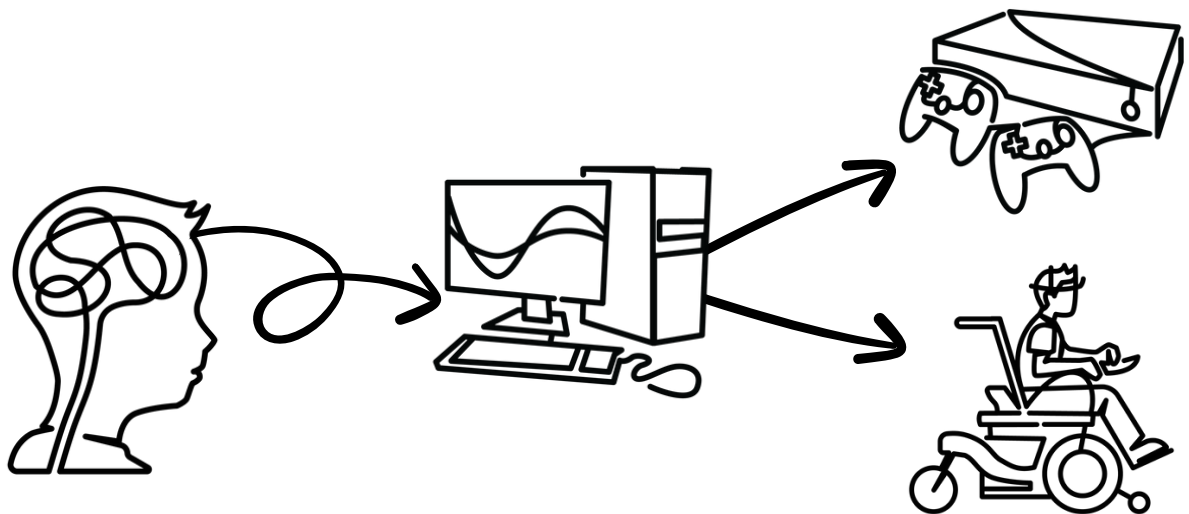


Liam wears a special cap that can read his brain waves and send messages to a computer.



The computer can translate these messages into actions. Actions like writing an email, turning lights on/off, playing a video game, and more.

Now that Liam has experienced more freedom, he feels like a tiger waiting for the exciting doors BCI research will open.



We need to enable the ability of children to play, learn, create and be heard. To offer this opportunity early in life, when it has the most profound effect, could be life-changing.

Dr. John Andersen, Lead Physician BCI, Glenrose Rehabilitation Hospital

Unleashing Tiger Superpowers

Why Pediatric BCI and Why the Glenrose?

Kids' brains are different. While adult brains have predictable parameters, less is understood about the pediatric brain. Thousands of youth in Alberta have neurological dysfunctions that severely affect movement or communication—for example, cerebral palsy; traumatic brain injury; movement disorders; spinal cord injury or any problems with spinal cord function; spinal muscular atrophy; Rett Syndrome.

These youth have potential that is just being discovered and developed through BCI use in hospital settings—BCI-CAN member hospitals in Calgary, Toronto and New York are influenced by the Glenrose Pediatric BCI team and its discoveries. Researchers without a hospital connection have shied away from Pediatric BCI's unique complexity. The Glenrose's interdisciplinary clinical approach, on the other hand, compelled its pediatric team to look seriously at what BCI might do for kids who appeared to have few options for engaging with the world because of neurological and neuromuscular disabilities—kids that might be cognitively gifted, but who felt hopeless.

Whether housed in an athlete's body or one with marked limitations, a mind is a powerful resource. By providing early access to BCI as a tool for building neural pathways and a sense of achievement, Pediatric BCI is unleashing some of that power.



The Commitment to Leadership & Research:

The Glenrose and its Allies on the World Stage

BCI is fast becoming a core technology in neurological and neuromuscular rehabilitation, but the gap between BCI development for adults and Pediatric BCI is growing—a fact noted by the Glenrose and two of Canada’s top pediatric rehabilitation researchers. The Glenrose joined with The Children’s Hospital in Calgary and Holland Bloorview Kids Rehabilitation Hospital in Toronto in 2018 to form BCI-CAN. Together, the BCI-CAN alliance is filling a gap between BCI developers and the families who need it to ensure that research and rehabilitation applications don’t get left behind.

Early research into pediatric BCI interventions is showing great potential to make a tremendous difference in pediatric neural and neuromuscular rehabilitation, thanks in part to the neuroplasticity of the pediatric brain.

As part of BCI-CAN, the Glenrose contributed:

1. vast clinical and assistive technology application experience,
2. research integrated into a clinical environment, and,
3. a unique patient-driven goals approach to Pediatric BCI.

For the Glenrose team, the question is: Bells, whistles and microchips aside, did this technology improve learning or participation in life? If not, can we modify the technology to help fulfill the patient’s goals in those areas?

In a relatively short time, BCI-CAN had exciting data to share at the 2020 conference of the international BCI Society in Brussels—the only research paper on Pediatric BCI on the program, and the Glenrose’s occupational therapist was the only pediatric therapy clinician workshop presenter on the topic. COVID-19 pre-empted the May conference, but BCI-CAN’s billing sent ripples throughout the BCI research world, and already two important US Pediatric BCI institutions have joined the alliance.



Creativity – coupled with curiosity and ability – builds the intensity necessary for leadership.

Lynette Lutes, Senior Operating Officer, Glenrose Rehabilitation Hospital

People + Technology = Alberta Rehab Powerhouse

The Glenrose can take the leadership role it is poised to seize for Alberta: It already has a strong, synergistic relationship with Alberta Children's Hospital and this relationship, growing through the BCI-CAN alliance, is stoking excitement at both institutions. With some investment in the Glenrose program, the Glenrose and Alberta Children's Hospital can collaboratively step into the gap that exists between adult-focused BCI and medical applications for children.

The first step is keeping Alberta's best by building on the existing collaboration between Alberta's Pediatric BCI leaders and attracting more top clinical, technical and academic people as well as industry partners. Engaging key people with enquiring minds and the skills to do the work is a proven formula for staying on the cutting edge.

By investing now in people to build its Pediatric BCI program, the Glenrose would create a serious focus for Alberta's formidable STEM talent, and build its reputation as a rehabilitation leader—not just in Canada but around the world.

130

visits per year at the Glenrose for children with traumatic brain injury.

931

children with cerebral palsy with regular follow up at the Glenrose since 2020

ASD

the Glenrose is a provincial screening centre for Autism Spectrum Disorder (ASD)



Glenrose Rehabilitation Hospital

Breaking Down Silos:

A New Centre for Innovation in Clinical Research and Rehabilitation

The collaborative nature of rehab innovation can be done most effectively when researchers work beside clinicians with patients.

Edmonton's Glenrose Rehabilitation Hospital and Calgary's Alberta Children's Hospital Pediatric BCI teams are convinced that understanding of the pediatric brain, patient and family centred practice, and BCI technology need to evolve in tandem in an interdisciplinary setting where neuroscientists, engineers, researchers and clinicians come together and partner with patients.

Interdisciplinary development in a clinical setting will accomplish two things:

1. The gap between pediatric and adult BCI can be minimized so that Pediatric BCI applications will not lag years behind adult applications
2. Greater understanding of the pediatric brain will lead to new understanding of and breakthroughs in adult BCI, resulting in technologies for emerging adult needs

BCI-CAN's current pre-eminence, its unique partnerships with world leaders in Pediatric BCI—they all point to Pediatric BCI as the first focus and testing ground of an interdisciplinary centre of innovation at the Glenrose.

An interdisciplinary centre of innovation at Glenrose Hospital could have a financially self-sustaining Pediatric BCI program within five years—a successful pilot program for attracting further investment in the centre.

BCI is here. The Pediatric BCI leadership clock is ticking. Liam's family is betting their futures on it.



The tiger is ready.

Unleash More Tigers

Invest in BCI to help break barriers for more kids

The opportunity and the path are clear: the Glenrose Hospital can assume an important position on the world stage through Pediatric BCI. The scientific and rehabilitation strides that will follow an investment now will secure the Glenrose's place as something bigger—a true rehabilitation innovator and leader.

The Glenrose Rehabilitation Hospital Foundation is committed to raising \$3.4 million for Pediatric BCI. By investing now in the Pediatric BCI program, you can help to:

- Make Pediatric BCI the flagship program of a new, self-sustaining Centre for Innovation in Clinical Research and Rehabilitation Advancement;
- Expand the international leadership role of the Glenrose and also Alberta in Pediatric BCI, and, most importantly;
- Positively change the futures of thousands of children in Alberta and millions around the world by unleashing more tigers

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