PI Profile

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B.Sc. (with distinction), University of Victoria
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Wikipedia Website:

https://en.wikipedia.org/wiki/Ryan_D%27Arcy

Publications:

https://scholar.google.ca/citations?user=APPBnh4AAAAJ&hl=en

Overview

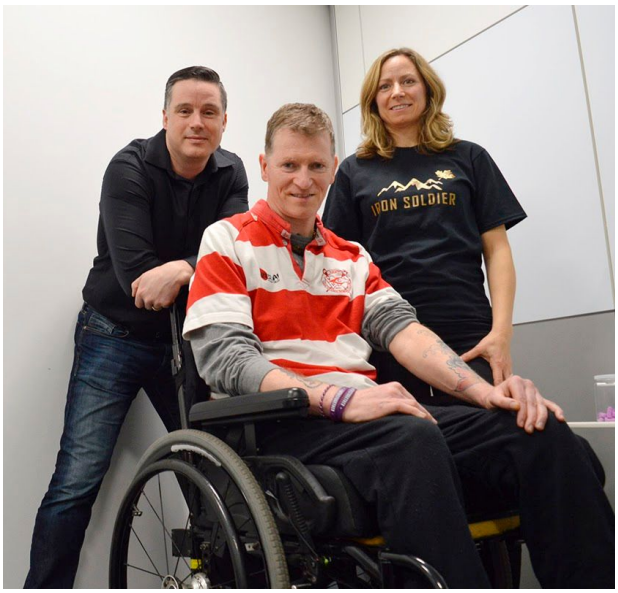
Dr. Ryan D'Arcy, PhD, EngL is one of the biggest names in neurotechnology and neuroimaging in our nation. Dr. D'Arcy has founded and co-found a number of neurotechnology organizations and initiatives, including HealthTech Connex (HTC). HTC spearheads some of the most groundbreaking advancements in neurotechnology, neuroscience, and medical imaging. He is also a Professor at Simon Fraser University (SFU) and the University of British Columbia (UBC), while holding a BC Leadership Chair in Medical Technology. His education includes a B.Sc. (with distinction) from the University of Victoria, a M.Sc. in neuropsychology and Ph.D. degree in neuroscience from Dalhousie University (Killam Scholar), and postdoctoral training in medical imaging physics at the National Research Council's Institute for Biodiagnostics. He also holds a professional engineering designation in Neurotechnology and Neuroimaging (Eng.L.).

Research

Project Iron Soldier and Captain (Retired) Trevor Greene

One of the most notable stories linked to D'Arcy and his research is the story of Captain (Retired) Trevor Greene. Greene, a Nova Scotia native, served in the Canadian Forces as a civil-military co-operation officer in Afghanistan. In a meeting with elders of the Shinkay village in 2006, Greene laid down his helmet and firearm as a sign of respect. Shortly after doing so, a 16- year-old shepherd boy came up behind him and swung an axe into Greene's head, splitting his skull. Although Greene survived the assault, doctors predicted a bleak prognosis; he would not be able to walk again. They told his wife, Debbie, to "stick him in a long term care home and get on with her life". See the recent TEDx talk by Greene and D'Arcy "Unleashing potential brain power" in 2020 (https://www.youtube.com/watch?v=-4QaroclkMs).

Thankfully, the Greene's ignored this piece of advice and instead focused on setting the seemingly impossible as a long-term goal. Greene was determined to walk again. While Dr. D'Arcy was watching The Peace Warrior - a documentary recounting Greene's injury and rehabilitation journey - he felt called to action. He knew that the brain's ability to recover could be underestimated, and that neuroplasticity could help change the course of Greene's recovery. From there, Trevor, Debbie and Ryan began with a 3- year brain imaging study that grew into much more. After only the second brain imaging session, Trevor and Debbie surprised the team with his ability to stand with some assistance. Things have only progressed from there, with wedding vows, the birth of their son, published books and scientific papers, exoskeletons, Invictus Games, innovative Royal Canadian Legions, and plans to reach Everest base camp. When the team needed to push the limits further, they sought out use of the PoNS™ device, a non-surgical medical device that uses tongue stimulation to facilitate neuroplasticity. This innovative technology has been seen to restore balance and gait in individuals managing various brain injuries, the clinical trials were conducted at HealthTech Connex.



Dr. D'Arcy, Trevor Greene, and his wife Debbie at HTC's Centre for Neurology Studies in Surrey (Photo: Reid, 2018).

An Inspiration to Many

Trevor Greene is just one of the many inspiring stories that has been written because of Dr. D'Arcy. Dr. D'Arcy has impacted many people around the world, both directly and indirectly,

by his neuroscientific research and passion for brain health and optimization. But beyond this, as a University Professor, he is also an inspiration for a younger generation of health technology students and trainees by exemplifying the capacity for scientific advancement and patient care in what appear to be impossible circumstances.

Awards

Dr. D'Arcy holds a variety of accolades, most notably: the Public Service Award of Excellence, The National Research Council's Research Breakthrough of the Year, and the Discovery Award for Innovation, among others. His favorite distinction remains "Kickass Canadian," for which Capt. Greene provided the nomination.

HealthTech Connex

In early August, VBIA representatives visited the Health and Technology District, home to HealthTech Connex, to tour the rising innovation ecosystem that is overcoming major hurdles in the field of brain injury and other brain conditions, daily.

Dr. D'Arcy emphasized that:

- There are a lot of innovations, but the road to helping is long and fraught with difficult challenges.
- There is a major gap between research and the integration to ensure leading innovations are accessible to all.
- Finding effective solutions requires a focused translational effort to connect the healthcare, university, and industry settings and accelerate progress.

Future goals in the field of brain injury are to "tap the inner innovators" in third party funding organizations to help improve access through subsidized costs. This will enable change from helping few to helping many regain functional improvements.

The NeuroCatch® Platform

As the saying in medicine goes: "You can't treat what you can't measure." To address this, Dr. D'Arcy led the creation of a scientific framework for brain vital signs. Emerging from this research, NeuroCatch® is the evidence-based technology that enables rapid, objective evaluation of cognitive functions using portable electroencephalogram (EEG). It extracts event-related potentials (ERPs) from EEG to provide the "ABCs" of cognitive function: **A**uditory sensation [N100], **B**asic attention [P300], and **C**ognitive processing [N400].

The first generation of the NeuroCatch® Platform is licensed by Health Canada as a Class II medical device and technology is deployed across leading clinical and research centres in North America.

NeuroCatch® and Concussion

NeuroCatch® technology is being put to use at the Mayo Clinic in the US for research on concussion in ice-hockey.

Article Summary

"Brain vital signs detect concussion-related neurophysiological impairments in ice hockey"

Fickling et al., 2019, Brain, Editors Choice.

Background

Concussions are a common concern in sport from recreational to amateur to professional leagues. This risk is increased in collision sports like ice hockey, which result in a higher frequency of sport-related concussions (SRC). Between 1997-2008, NHL athletes sustained roughly 69 concussions in the league each year, not accounting for any practices or off-season game play (Wennberg & Tator, 2008) or the increasing concern around subconcussive impacts (Fickling et al., 2019). This increased rate of concussions is thought to be associated with impairments later in life, including mental health and cognitive issues.

Why it's Important

Currently, sports medicine professionals are limited by a lack of objective tests to inform clinical decisions, which can have a great impact on rehabilitation and return-to-play (RTP) protocols. Given that neurophysiological impairments can persist longer than observable clinical signs and symptoms, an accurate clinical diagnosis is crucial in assessing whether an athlete can return-to-play safely.

Methods

Participants were active Junior-A hockey players who were evaluated using a research-based NeuroCatch® during pre-season baseline, immediately after concussion, at return-to-play, and post-season (n=43). Twelve players were diagnosed with concussion over the study.

Main Findings

The study findings showed significant changes in amplitudes and latencies of all three ERP responses after concussion, with residual deficits in the P300 at return-to-play (Basic attention). Importantly, significant deficits in the N400 latencies (Cognitive processing) were detected in the players without a concussion diagnosis - implicating the role of subconcussive impacts from the physical nature of the sport.

Limitations

Concussion studies are always in need of larger sample sizes, with subsequent work expanding the sample sizes and replicating the results not only in hockey, but in other contact sports (e.g., football). Normative ranges are also being established following this study to help with future clinical uses. Accordingly, the subconcussive changes cannot be assumed to be solely caused by accumulated subconcussive impacts without further validation (Fickling et al., 2019). A follow up replication has recently been submitted for publication.

Future Directions

There is an ongoing need for an objective, easy-to-use evaluation of cognitive brain function, which can inform critical decisions in brain injury management.

References

D'Arcy, R., Dr., & Greene, T., Capt. (Speakers). (2020). *Unleashing Potential Brain Power*. TEDx Bear Creek Park., Surrey, British Columbia.

Fickling, S. D., Smith, A. M., Pawlowski, G., Hajra, S. G., Liu, C. C., Farrell, K., . . . D'Arcy, R. C. (2019). Brain vital signs detect concussion-related neurophysiological impairments in ice hockey. *Brain, 142*(2), 255-262. doi:10.1093/brain/awy317

GET INVOLVED...

AS AN INDIVIDUAL

If you are a concerned member of the community who would like to support this project, raise awareness, or volunteer your time, please register as a VBIA volunteer.

AS AN ORGANIZATION

If you are an organization, school, or society and would like to raise awareness and support for the Concussion Diagnosis Project, please contact us.

AS A RESEARCHER

If you have expertise in studying brain injury, please join our growing group of collaborators.

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HOW IS VBIA GOING TO HELP?

Watch for our monthly PI PROFILE to read more about brain injury research!