Parkinson Society British Columbia

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Research Profile:
Dr. Mark Carpenter
Associate professor, and Tier II Canada Research Chair in Physical Activity and Health in the School of Kinesiology at the University of British Columbia

Research Project:
A novel fMRI approach to investigating the pathophysiology of postural instability in Parkinson's disease.

Project Grant: $45,000

Project Description:
Balance and the Brain

"We hope we'll be able to identify the unique areas of the brain that are involved in balance and might be affected by Parkinson's disease."

Balance problems that result in falls are a major problem for people with Parkinson's disease – a problem unresolved by medication or surgery that relieves other motor symptoms.

At the University of British Columbia, neuroscientist Mark Carpenter investigates the causes of balance instability and falls, as well as why this symptom of Parkinson's doesn't respond to current treatments.

Carpenter wonders whether balance is controlled by other areas of the brain than the regions that control other motor functions. He's also considering the possibility that people with Parkinson's disease are unable to detect where their limbs are in space, a phenomenon called proprioception. Using functional Magnetic Resonance Imaging (fMRI) to scan the brains of people with Parkinson's disease while they perform a balancing task, Carpenter will try to determine what structures in the brain control balance and where they are located.

“If we can understand which areas of the brain are controlling balance, and if there's evidence that Parkinson's disease affects those areas, then we have new targets for treatment or new ways of trying to understand the causes of falls,” Carpenter says.

Carpenter and his team are developing a balance simulator that people can control while they are lying in the brain imaging machine, by balancing an inverted pendulum with their ankles. The simulator will engage some of the same muscles and feedback systems the brain uses while balancing, allowing the researchers to capture more accurate images of the regions in the brain that are involved in balance. Comparing the images captured during the balance task, with images from non-balance tasks, like returning their ankle to a neutral position, helps determine how proprioception may contribute to the balance problems in people with Parkinson’s.

Ultimately, by understanding what areas of the brain are directly involved in balance, Carpenter hopes to open up a new treatment avenue that targets these additional regions of the brain, to reduce the balance problems and falls that people with Parkinson's disease experience.

Biography:
Dr. Mark Carpenter is an Associate professor, and Tier II Canada Research Chair in Physical Activity and Health in the School of Kinesiology at the University of British Columbia. After receiving his PhD in Kinesiology at the University of Waterloo in 2001, he completed a post-doctoral fellowship at the Karolinska Institute in Stockholm, Sweden, before beginning his position at the University of British Columbia in 2005.

His research aims to identify the physiological and psychological factors that contribute to balance deficits and falls associated with age, vestibular loss and neurological disorders, such as Parkinson’s disease, and to help develop optimal exercise, training and treatment strategies to improve age and disease-specific balance deficits and reduce the occurrence and impact of falls. Dr. Carpenter has authored more than 80 peer-reviewed journal articles on the topics of balance, falls and the neural control of posture and movement.