Notice of the Final Oral Examination
for the Degree of Doctor of Philosophy

of

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MSc (University of British Columbia, 2010)
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“A Dissertation on Nervous System Control and Interlimb Coordination During Rhythmic Movement and on Locomotor Recovery After Stroke”

School of Exercise Science, Physical and Health Education

Monday, October 31, 2016
9:00 a.m.
McKinnon Building
Room 0025

Supervisory Committee:
Dr. E. Paul Zehr, School of Exercise Science, Physical and Health Education, University of Victoria (Supervisor)
Dr. Sandra Hundza, School of Exercise Science, Physical and Health Education, UVic (Member)
Dr. Brian Christie, Division of Medical Services, UVic (Outside Member)

External Examiner:
Dr. John Misiaszek, Department of Rehabilitation Medicine, University of Alberta

Chair of Oral Examination:
Dr. Sonya Bird, Department of Linguistics, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies
Abstract

For those who have suffered a stroke, damage to the brain can result in a decreased ability to walk. The traditional therapy used for the recovery of walking, body weight supported treadmill training, has significant labour requirements that limit the availability of training to the larger stroke population. Thus, the conception and application of new, effective, and efficient rehabilitation therapies is required.

To approach this, an understanding of the intricate neural control behind walking is needed to form the principled foundation upon which locomotor therapies are based. Due to observations that the arms and legs are connected in the nervous system during walking, and that nervous system control is the same across rhythmic tasks, arm and leg (A&L) cycling training could provide an effective means of locomotor rehabilitation.

Thus, the goal of this dissertation is focused upon exploring central nervous system control and interlimb coordination during rhythmic arm and leg movement and testing the extent to which A&L cycling training improves walking after stroke.

The first objective of this dissertation was to provide further evidence of central nervous system control of walking. Through a literature review in Chapter 1 and experimental evidence in Chapter 2 of common subcortical control across rhythmic locomotor tasks, evidence for the existence of central pattern generating networks in humans is given.

The second objective was to explore interlimb coordination during rhythmic movement. Results presented in Chapters 3 and 4 further our understanding of specific interlimb interactions during rhythmic arm and leg tasks.

The third objective was to evaluate the effects of an A&L cycling training intervention in a post-stroke population. To support this objective, it was shown in Chapter 5 that a multiple baseline design is appropriate for use in intervention studies. In Chapter 6, it was determined that A&L cycling training can be used to improve walking ability. And in Chapter 7, it was shown that training induced plasticity in interlimb reflex pathways.

Overall, results in this dissertation provide further knowledge on nervous system control and arm and leg interlimb interactions during rhythmic movements and their effect on locomotor recovery following a stroke.