



University  
of Victoria

Graduate Studies

Notice of the Final Oral Examination  
for the Degree of Master of Science

of

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BSc (University of Lethbridge, 2013)

**“Rhythmic Arm Cycling Training Improves Walking and Interlimb  
Integrity in Chronic Stroke”**

Neuroscience in the Division of Medical Sciences

Monday, December 17, 2018  
10:00 A.M.  
Medical Sciences Building  
Room 210

Supervisory Committee:

Dr. Paul E. Zehr, School of Exercise, Science, Physical & Health Education, University of Victoria  
(Supervisor)

Dr. Craig Brown, Division of Medical Sciences, UVic (Outside Member)

External Examiner:

Dr. Marc Klimstra, School of Exercise, Science, Physical & Health Education, UVic

Chair of Oral Examination:

Dr. Nigel Livingston, School of Public Health and Social Policy, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

## **Abstract**

Training locomotor pattern generating networks (CPGs) with body weight supported treadmill training or through arm and leg cycling improves walking in chronic stroke. These outcomes are presumed to result from enhanced interlimb connectivity and CPG function. The extent to which rhythmic arm training activates interlimb CPG networks for locomotion remains unclear and was assessed by studying chronic stroke participants before and after 5-weeks of arm cycling training. Strength was assessed bilaterally via maximal voluntary isometric contractions in the legs and hands. Muscle activation during arm cycling and transfer to treadmill walking were assessed in the more affected (MA) and less affected (LA) sides via surface electromyography. Changes to interlimb coupling during rhythmic movement were evaluated using modulation of cutaneous reflexes elicited by electrical stimulation of the superficial radial nerve at the wrist. Bilateral soleus stretch reflexes were elicited at rest and during 1Hz arm cycling. Clinical function tests assessed walking, balance and motor function. Results show significant changes in function and neurophysiological integrity. Training increased bilateral grip strength, force during MA plantarflexion and muscle activation. 'Normalization' of cutaneous reflex modulation was found during arm cycling. There was enhanced activity in the dorsiflexor muscles on the MA side during swing phase of walking. Enhanced interlimb coupling was shown by increased modulation of MA soleus stretch reflexes amplitudes during arm cycling after training. Clinical evaluations showed enhanced walking ability and balance. These results are consistent with training-induced changes in CPG function and interlimb connectivity and underscore the need for arm training in the functional rehabilitation of walking after neurotrauma.