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

of

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MSc (Universitat Pompeu Fabra, 2014)
BSc (Universitat of Barcelona, 2013)

“Effects of Mild Traumatic Brain Injury on Hippocampal Synaptic Plasticity and Behaviour in Juvenile Rats”

Division of Medical Sciences

Wednesday, October 23, 2019
9:00 A.M.
Medical Sciences Building
Room 160

Supervisory Committee:
Dr. Brian Christie, Division of Medical Sciences, University of Victoria (Supervisor)
Dr. Leigh Anne Swayne, Division of Medical Sciences, UVic (Member)
Dr. Raad Nashmi, Department of Biology, UVic (Outside Member)

External Examiner:
Dr. Liisa Galea, Department of Psychology, University of British Columbia

Chair of Oral Examination:
Dr. Michelle Wiebe, Department of Curriculum and Instruction, UVic
Abstract

Traumatic Brain Injury (TBI) is a global health problem and concussion, or mild TBI (mTBI), accounts for up to 75% of all brain injuries occurring annually in the US. There is also growing awareness that repeated mild traumatic brain injury (r-mTBI) can result in cumulative neuropathology and learning and memory deficits, however there is a paucity of preclinical data as to the extent these deficits manifest. R-mTBI in juvenile populations is of special interest as not only is this a high risk group, but this is also a time period when the human brain continues to mature. The hippocampus is a brain region important for learning and memory processes, and r-mTBI during the juvenile period may particularly disrupt the development of cognitive processes.

To examine this issue we used a model of awake closed head injury (ACHI), and administered 8 impacts over a 4 day period to juvenile male and female rats (P25-28). At 1 or 7 days after the last injury, a cohort of rats was used for behavioural testing to study anxiety and risk-taking behaviours and cognitive abilities. From a different cohort, hippocampal slices were generated and used for in vitro electrophysiological recordings, and the capacity for long-term depression (LTD) and long-term potentiation (LTP) was examined in the medial perforant path (MPP)-dentate gyrus (DG) synapse.

Our results showed that r-mTBI impaired hippocampal-dependent spatial learning and memory and that r-mTBI significantly impaired the capacity for LTD but not LTP in both sexes. These data are the first to describe the negative impact of r-mTBI on LTD in the juvenile DG in both males and females, and provide evidence for the delayed development of neurological deficits with r-mTBI.