The Final Oral Examination
for the Degree of

DOCTOR OF PHILOSOPHY
Biology (Neuroscience)

Anna Patten
2006 University of Otago Hons. B.Sc.

“Replenishing what is Lost: Using Supplementation to Enhance Hippocampal Function in Fetal Alcohol Spectrum Disorders”

April 9th, 2013
9:00 am
Medical Sciences Building, room MSB 210

Supervisory Committee:
Dr. Brain Christie, Department of Biology, UVic (Supervisor)
Dr. Leigh Anne Swayne, Department of Biology, UVic
Dr. Francis Choy, Department of Biology, UVic
Dr. Robert Burke, Department of Biochemistry and Microbiology, UVic (Outside Member)

External Examiner:
Dr. Jason Snyder, Department of Psychology, University of British Columbia

Chair of Oral Examination:
Dr. Venkatesh Srinivasan, Department of Computer Science, UVic
Abstract
Fetal Alcohol Spectrum Disorders (FASD) are the most common cause of cognitive impairment in the United States (Sokol et al 2003). In young school children in North America and some Western European countries, recent reports have estimated the prevalence of FASD to be as high as 2-5% (May et al 2009). Currently there are no widely accepted treatment options for FASD, mainly due to the fact that the underlying neurological deficits that occur with prenatal ethanol exposure (PNEE) are still largely unknown. My thesis examines the long-lasting changes that occur in the hippocampus following PNEE using both biochemical and electrophysiological techniques. We find that PNEE produces a drastic reduction of the endogenous antioxidant glutathione (GSH), resulting in an increase in oxidative stress that is accompanied by long-lasting reductions in long-term potentiation (LTP) of synaptic efficacy. Interestingly, males exhibited greater deficits in synaptic plasticity than females, despite similar reductions in GSH in both sexes. By depleting GSH in control animals we determined that LTP in the DG of female animals is more resistant to changes in GSH, which may explain the sexual dichotomy observed in these studies of PNEE. Based on these findings, ethanol-exposed animals received postnatal dietary supplementation with either a precursor of GSH, N-Acetylcysteine (NAC) or Omega-3 fatty acids. These supplements helped to counteract the effects of PNEE and improved hippocampal function. The findings from these studies support the hypothesis that increasing antioxidant capacity can enhance hippocampal function, which in turn may improve learning and memory in FASD, providing a therapeutic avenue for children suffering with these disorders.

Awards, Scholarships, Fellowships
2012 NeuroDevNet Doctoral Fellowship recipient
2012 University of Victoria Fellowship
2011 Neena Chappell Scholarship
2011 University of Victoria Fellowship
2010 Pacific Century Graduate Scholarship
2010 University of Victoria Fellowship
2010 Research Society on Alcoholism Memorial Award
2009 Pacific Century Graduate Scholarship

Presentations
3. Guest Speaker for Division of Medical Sciences “Lunch and Learn” Series at the University of Victoria January 2012. “Omega-3 Fatty Acids and Fetal Alcohol Spectrum Disorders” (oral)

4. H. Sickmann, A. Patten and B.R. Christie “Sex-differences in the effects of omega-3 fatty acid dietary supplementation on long-term potentiation following prenatal ethanol exposure” presented at Society for Neuroscience Conference Nov 2011 (poster)

5. Presentation at Research Society of Alcoholism Conference Symposium June 2010: Exercising some control over how alcohol affects the brain? - Effects of exercise on adult hippocampal neurogenesis following pre- and post-natal ethanol exposure (oral)


**Publications**

1. **Anna R. Patten**, Patricia Brocardo, Brian Christie (2012). Prenatal ethanol exposure causes long-term deficits in antioxidant capacity that can be partially restored by omega-3 supplementation. *Journal of Nutritional Biochemistry (in press).*


3. Fanny Boehme, Joana Gil-Mohapel, Adrian Cox, **Anna Patten**, Erica Giles, Patricia S. Brocando, and Brian R. Christie (2011) Voluntary Exercise Induces Adult Hippocampal Neurogenesis and BDNF


