Reduced Brain Choline in Adolescent Hockey Players after Concussion
Amy Schranz
Supervised by Dr. Bartha

**Introduction.** A concussion is a brain injury caused by forces applied to the head or another part of the body, causing the brain to experience rapid rotational and translational accelerations. Because concussion is difficult to diagnose and the prognosis post-concussion is also difficult to ascertain, athletes often return to sports before concussion is fully resolved, which increases the risk of another serious brain injury. Biomarkers of concussion are urgently required in order to measure concussion and its recovery. In concussion, diffuse axonal injury and a secondary chemical cascade can result in mitochondrial dysfunction and altered metabolism, which have the potential to manifest into changes in brain metabolites. Therefore, measuring metabolites may provide a means to detect this chemical cascade and therefore detect concussion. In particular, the occurrence of these events within the frontal lobes can lead to executive dysfunction, and potentially neurodegeneration. As a result, the purpose of this study was to use magnetic resonance spectroscopy to measure metabolites in the prefrontal white matter of male athletes after concussion.

**Methods.** Male adolescent hockey players from the Bantam Division were enrolled in the study (ages 11-14). Players were subdivided into two groups; those diagnosed with a single concussion (n=12) and age matched controls (n=18). MRI was acquired using a 3.0T Siemens MRI scanner (Erlangen, Germany). Concussed athletes were evaluated 24-72 hours post-concussion and followed up 3 months later. Magnetic resonance spectroscopy (MRS) was acquired from the prefrontal white matter using single voxel point-resolved spectroscopy (PRESS: TE/TR=135/2000ms, voxel=2x2x1.5 cm³, 192 averages). Spectra were post-processed using in-house software to measure absolute N-acetyl aspartate, choline, creatine, glutamate, glutamine, and myo-inositol. A one-way ANOVA was used across all three groups, and all multiple comparisons were Tukey corrected.

**Results and Discussion.** A reduction in choline was observed 3 months post-concussion compared to controls. The choline signal is primarily composed of phosphorylcholine and glycerophosphorylcholine, which reflects cell membrane turnover. This suggests the reduction in choline signal may be due to a reduced membrane turnover rate. No other metabolite changes were observed in either group.