# Glutamate Receptor Expression After Traumatic Brain Injury In A Rat Model Of Depression

Maxon Knott[1]
Erika Correll[2], Noah Ziemba[3], Laura Ngwenya[4] and Jennifer McGuire[4]

[1] University of Cincinnati
[2] Neuroscience and Behavior Program, University of Massachusetts
[3] University of Pittsburgh
[4] Department of Neurosurgery, University of Cincinnati

Traumatic Brain Injury (TBI) patients with pre-existing psychiatric diagnoses have worse outcomes after TBI but are almost universally excluded from clinical TBI research. In order to study processes that impede recovery in vulnerable individuals, we used the Wistar-Kyoto (WKY) rat. The WKY strain has a behavioral phenotype that recapitulates aspects of human depression. Dysregulation of glutamate signalling is implicated in the etiology of multiple neurobehavioral disorders including major depression. We hypothesized that TBI would impact glutamate signalling more in the WKY rats than the Wistar (WIS) parent strain. We used the lateral fluid percussion model to induce TBI in adult male WKY and WIS rats, with sham controls for each strain. We used Western blotting to determine protein levels of α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) receptor subunits, GluA1 and GluA2, N-methyl-D-aspartate (NMDA) receptor subunits, GluN2A and GluN2B, and the astrocytic glutamate transporter GLAST in the hippocampus 21 days after TBI. Western blot data were analyzed using two-way ANOVA. We found no effect of strain or TBI on expression of GluA1 or GluA2. Expression of GluN2A was significantly higher in WKY than WIS rats ($p=0.014$) but was unaffected by TBI. GLAST expression was also higher in WKY rats (strain, $p=0.0315$) and not significantly altered by TBI. We found a significant effect of TBI ($p=0.018$) and an interaction of TBI and strain ($p=0.005$) on expression of GluN2B. GluN2B protein was significantly increased after TBI in WIS rats compared to WIS sham ($p=0.0023$) and both WKY groups (WKY sham, $p=0.031$; WKY TBI, $p=0.017$). Our data indicate that there are initial differences in expression of glutamate receptors and transporters between WIS and WKY strains and divergent changes between WIS and WKY in the composition of glutamate receptors after TBI. Contrary to our expectations, TBI altered expression of glutamate receptors in WIS but not WKY. Further work will be required to determine how the differences in glutamate regulation between strains impact downstream signalling events regulating synaptic plasticity and cognition.