Neurobehavioral and Psychological Health Outcomes

Defining the Genetic Changes after Blast Injury to the Retina

Researchers and clinicians in the Department of Ophthalmology at Emory University are characterizing the effects of 48 pounds per square inch blast injury to the eye and retina. They are using a mouse model and a complex genetic analysis to define the molecular changes occurring in the retina following blast injury. The microarray datasets include one dataset from naïve uninjured mice (58 strains of mice and 222 microarrays looking at over 50,000 genomic elements) and a second dataset from mice five days after a blast injury to the eye (54 strains of mice and 213 microarrays). These large datasets provide the power to see changes caused by the blast injury for the very first time.[1,2] They have identified highly significant (false discovery rate < 0.001) changes in 13,971 genomic elements. Although the analysis is not yet completed, there are several themes emerging from the data. Following blast injury, there is a modest but real decrease in genes associated with metabolism. There are also changes associated with the normal functioning of cells in the retina. Many of the genes increasing in expression following blast injury are associated with the innate immune system and the chronic infiltration of T-cells. To investigate the possibility that lymphocytes were invading the retina, the study team examined a blast eye seven, 14 and 21 days following the initial injury and found a significant number of invading T-cells. Together the data point to an insidious cascade of events that may be slowly altering the normal functioning of the retina. In the mouse model, there is a progressive loss of visual function that proceeds for at least two months. The molecular events seen at five days after blast injury may be the beginning of events that lead to this loss of vision. Researchers are now examining the changes in the retina to identify potential drug targets that could alter or stop the observed genetic changes with the hope that stopping this detrimental process should halt or reverse the loss of vision. These studies are funded by the Psychological Health/Traumatic Brain Injury Research Program (PH/TBIRP) managed by the Congressionally Directed Medical Research Program (CDMRP).

1 King, R., Lu, L., Williams, R. W., & Geisert, E. E. (2015). Transcriptome networks in the mouse retina: An exon level BXD RI database. Molecular Vision, 21, 1235–1251.

2 Struebing, F. L., Lee, R. K., Williams, R. W., & Geisert, E. E. (2016). Genetic Networks in Mouse Retinal Ganglion Cells. Frontiers in Genetics, 7, 169. https://doi. org/10.3389/fgene.2016.00169