OMICS International
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Jing Zhang et al., J Mol Biomark Diagn 2015, 6:4
http://dx.doi.org/10.4172/2155-9929.C1.025

Mammalian hair follicles: Insights into microRNAs as a traumatic brain injury (TBI) biomarker

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With the wide adoption of explosive-dependent weaponry, blast-induced traumatic brain injury (TBI) has become a significant medical issue for military personnel. Recently, the implementation of microRNAs (miRNA) as a clinical biomarker has proposed for diseases including several types of cancer. The interaction between miRNAs and their corresponding mRNA targets usually leads to translational silencing or mRNA degradation. This work investigates the involvement of miRNAs in primary shockwave-induced TBI responses in rat whisker follicles. With an advanced blast simulator, we assess the molecular responses in the whisker follicles in the rat model that was expose under a series of single blast intensities (15, 20, 25 and 30 psi). Gene networks form iRNA-dependent gene expression were constructed using sub-network enrichment analysis (SNEA) with respect to shared and shockwave intensity-specific microarray transcription profiling. Based on the SNEA analysis, core miRNAs (miR-26a, -27b, -29a, -34a, -181c and -183), were measured using quantitative RT-PCR. All the miRNA levels tested decreased in abundance in the whisker follicles following shockwave exposures. The results suggest shared responses across multiple intensity exposures, example miR-183 in all intensities, whereas exposures at 15 and 20 psi triggered specific miRNA expressions, i.e., miR-29a and -34a respectively. Multiple pathways and biological processes (example DNA repair and mRNA processing), were enriched following a gene set enrichment analysis (GSEA). Our study provides the first evidence that miRNAs are responsive to shockwave exposures in mammalian hair follicles and these molecules may be useful biomarkers for primary blast-induced TBI.

Biography

Jing Zhang is a recent PhD graduate from Carleton University under Dr. Kenneth Storey's supervision and joined Dr. Valerie Langlois' group as a Post-doctoral fellow in the fall of 2013. His field is molecular physiology and previous work includes investigating molecular mechanisms behind survival adaptions under extreme environmental conditions in various stress tolerant animal models. Currently, he is focusing on exploring the potential of hair follicle as a diagnostic tool for military activity-related medical conditions including traumatic brain injury (TBI) and operational stress disorders using transcriptomic approaches.

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