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Hair follicle gene expression profiling: A novel system for exploring biomarkers in military operational stress disorders

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Military personnel commonly exposed to operational stressors (example, intense physical exertion, sleep deprivation and fatigue) during both training activities and combat operations, which are often, associated with mental health disorders including depression and post-traumatic stress disorder. As psycho-physiological changes driven by molecular mechanisms, it is useful to assess corresponding adaptations in gene expression profiles for a better understanding of such responses. Thus, we explored human hair follicles as a robust and accessible biomarker system for both characterization and diagnostic purposes. Four healthy male volunteers performed a 2-week period of high-intensity interval training (HIIT) as an easily quantifiable and reproducible physical stress model. RNA-sequencing was conducted on an Illumina MiSeq platform using the total RNA libraries prepared from the hair follicles collected from the vertex area of the scalp pre- and post-HIIT. The resulting RNA sequences aligned to the human genome. Differential expression (DE) analyzed for protein coding RNA (mRNA), miRNA and long non-coding RNA (lncRNA). Gene ontology (GO) term analysis also conducted. Based on the DE mRNA results, the GO term enrichment showed 192 positively affected terms (example, hormonal control), while 387 (example, immune system process) were negatively enriched upon HIIT. Regarding to miRNA, 48 related GO terms (example, antioxidant response) enriched. We also identified 249 differentially expressed lncRNAs including those involved in RNA processing (example, RMRP). Overall, this study demonstrates that human hair follicles are a valuable resource inproviding molecular signatures linked to operational stress disorders.

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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