Informing rodent behavior in space: Gene Expression and Hyper-Emotionality Following Prenatal Stress

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As space exploration pushes our boundaries further away from Earth and for longer durations, we will inevitably require the use of multi-generational studies to continue our expansion. Space is a stressful environment not only due to the deleterious effect of spaceflight on physiology, but also due to confinement, limited social interactions, inherently dangerous circumstances, and many other stresses of an unknown environment. Stress can alter the brain chemistry, and these alterations can affect behavior at all stages of development, but it is especially pronounced during the perinatal period and can have longstanding effects, even into adulthood, which manifest through augmented brain function and psychopathology. This study investigated the nexus of brain chemistry and brain function by observing behavior of adult rats whose mothers were exposed to unpredictable variable prenatal stress (UVPS) while they were in the womb. The UVPS consisted of strobe light, tube restraint, and white noise, and was administered at unpredictable times of the day and also varied in length, both of which were measures taken to prevent habituation to the stressor. The offspring rats were then allowed to reach adulthood and at 90 days were subjected to a series of behavioral tests including novel object, startle response, and an unknown intruder to quantify the adult rat's stress response and anxiety. Here we report these results of the behavioral analysis and correlate adult behavioral measures with the expression of genes involved in the hypothalamic-pituitary-adrenal axis, which modulates the animal's stress response. We hypothesized that hyper-expression of genes involved in the HPA axis would correlate with the observed anxiety-like behaviors associated with early stress. Funded by NICHD (1R01HD50201) to AER.