EFFECTS AND RESPONSES TO SPACEFLIGHT IN THE MOUSE RETINA

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Several stress environmental factors are combined in a unique fashion during spaceflight, affecting living beings widely across their physiological systems. Recently, attention has been placed on vision changes in astronauts returning from long duration missions. Alterations include hyperoptic shift, globe flattening, choroidal folds and optic disc edema, which are probably associated with increased intracranial pressure[1]. These observations justify a better characterization of the ocular health risks associated with spaceflight. This study investigates the impact of spaceflight on the biology of the mouse retina. Within a successful tissue sharing effort, eyes from albino Balb/cJ mice aboard STS-133 were collected for histological analysis and gene expression profiling of the retina at 1 and 7 days after landing. Both vivarium and AEM (Animal Enclosure Module) mice were used as ground controls. Oxidative stress-induced DNA damage was higher in the flight samples compared to controls on R+1, and decreased on R+7. A trend toward higher oxidative and cellular stress response gene expression was also observed on R+1 compared to AEM controls, and these levels decreased on R+7. Several genes coding for key antioxidant enzymes, namely, heme-oxygenase-1, peroxiredoxin, and catalase, were among those upregulated after flight. Likewise, NFκB and TGFbeta1, were upregulated in one flight specimen that overall showed the most elevated oxidative stress markers on R+1. In addition, retinas from vivarium control mice evidenced higher oxidative stress markers, NFκB and TGFbeta1, likely due to the more intense illumination in vivarium cages versus the AEM. These preliminary data suggest that spaceflight represents a source of environmental stress that translates into oxidative and cellular stress in the retina, which is partially reversible upon return to Earth. Further work is needed to dissect the contribution of the various spaceflight factors (microgravity, radiation) and to evaluate the impact of the stress response on retinal health.

1. Mader TH, et al. (2011) *Ophthalmology* **118**(10): 2058-69.