Mouse behavior on ISS: The emergence of a distinctive, organized group circling behavior unique to spaceflight

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As interest in long duration effects of space habitation increases, understanding the behavior of model organisms living within the habitats engineered to fly them is vital for designing, validating, and interpreting future spaceflight studies. Only a handful of papers have previously reported behavior of mice and rats in the weightless environment of space (Andreev-Andrievskiy, et al., 2013; Cancedda et al., 2012; Ronca et al., 2008). The Rodent Research Hardware and Operations Validation Mission (Rodent Research-1; RR1) utilized the Rodent Habitat (RH) developed at NASA Ames Research Center to fly mice on the ISS. Ten adult (16-week-old) female C57BL/6J mice were launched on September 21st, 2014 in an unmanned Dragon Capsule, and spent 37 days in flight. Here we report group behavioral phenotypes of the RR1 Flight (FLT) and environment-matched Ground Control (GC) mice in the RH during this long duration flight. Video was recorded for 34 days on the ISS, permitting daily assessments of overall health and well being of the mice, and providing a valuable repository for detailed behavioral analysis. As compared to GC mice, RR1 FLT mice exhibited the same range of behaviors, including eating, drinking, exploration, self- and allo-grooming, and social interactions at similar or greater levels of occurrence. Overall activity was greater in FLT as compared to GC mice, with spontaneous ambulatory behavior, including organized circling or *'race-tracking'* behavior that emerged within the first few days of flight following a common developmental sequence, comprising the primary dark cycle activity of FLT mice. Circling participation by individual mice persisted throughout the mission. Analysis of group behavior over mission days revealed recruitment of mice into the group phenotype, coupled with decreasing numbers of collisions between circling mice. This analysis provides insights into the behavior of mice in microgravity, and clear evidence for the emergence of a distinctive, organized group behavior unique to the weightless space environment.

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