Transcriptomic changes in an animal-bacterial symbiosis under modeled microgravity conditions.

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Introduction: Spaceflight imposes numerous adaptive challenges for terrestrial life. The reduction in gravity, or microgravity, represents a novel environment that can disrupt homeostasis of many physiological processes. Additionally, it is becoming increasingly clear that an organism's microbiome is critical for host health and examining its resiliency in microgravity represents a new frontier for space biology research. In this study, we examine the impact of microgravity on the interactions between the squid *Euprymna scolopes* and its beneficial symbiont *Vibrio fischeri*, which form a highly specific binary mutualism. First, animals inoculated with *V. fischeri* aboard the space shuttle showed effective colonization of the host light organ, the site of the symbiosis, during space flight. Second, RNA-Seq analysis of squid exposed to modeled microgravity conditions exhibited extensive differential gene expression in the presence and absence of the symbiotic partner. Transcriptomic analyses revealed in the absence of the symbiont during modeled microgravity there was an enrichment of genes and pathways associated with the innate immune and oxidative stress response. The results suggest that *V. fischeri* may help modulate the host stress responses under modeled microgravity. This study provides a window into the adaptive responses that the host animal and its symbiont use during modeled microgravity.