Effects of simulated microgravity on a host-pathogen system

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While it has been shown that decades of astronauts and cosmonauts can suffer from illnesses both during and after spaceflight, the underlying causes are still poorly understood, due in part to the fact that there are so many variables to consider when investigating the human immune system in a complex environment. Invertebrates have become popular models for studying human disease because they are cheap, highly amenable to experimental manipulation, and have innate immune systems with a high genetic similarity to humans. Fruit flies (*Drosophila melanogaster*) have been shown to experience a dramatic shift in immune gene expression following spaceflight, but are still able to fight off infections when exposed to bacteria. However, the common bacterial pathogen *Serratia marcescens* was shown to become more lethal to fruit flies after being cultured in space, suggesting that not only do we need to consider host changes in susceptibility, but also changes in the pathogen itself after spaceflight conditions. Being able to simulate spaceflight conditions in a controlled environment on the ground gives us the ability to not only evaluate the effects of microgravity on the host immune system, but also how the microorganisms that cause immune disorders are being affected by these drastic environmental shifts. In this study, I use a ground-based simulated microgravity environment to examine the genetic changes associated with increased *S. marcescens* virulence in order to understand how microgravity is affecting this pathogen, as well as how these genetic changes influence and interact with the host immune system. This study will provide us with more directed approaches to studying the effects of spaceflight on human beings, with the ultimate goal of being able to counteract immune dysfunction in future space exploration.