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Biology in Space (8)

Author: Ms. Lily A. Allen
University of Colorado Boulder, United States, Lily.Allen@Colorado.EDU

Mr. Tadg Forward
University of Colorado Boulder, United States, Tadg.Forward@Colorado.EDU
Dr. Louis Stodieck
University of Colorado Boulder, United States, Stodieck@Colorado.edu
Prof. David Klaus
University of Colorado Boulder, United States, Klaus@colorado.edu
Dr. Luis Zea
University of Colorado Boulder, United States, Luis.Zea@Colorado.edu

GROWTH DYNAMICS OF BACTERIA UNDER SIMULATED LUNAR AND MARTIAN GRAVITIES

Abstract

Microbial (bacteria and fungi) behavior has been observed to change in microgravity with, for example, enhanced bacterial growth, augmented cell aggregation, increased virulence, and reduced susceptibility to antibiotics having been reported from numerous spaceflight experiments. However, these parameters have not been systematically assessed at partial levels of gravity relevant to space exploration such as 1/6 g (Lunar-surface equivalent) and 1/3 g (Martian-surface equivalent). This NASA-funded project examines the growth dynamics of multiple commensal, opportunistic, human microbiome-associated, and (some) pathogenic bacterial and fungal strains under simulated micro-, Lunar-, and Martian-gravities, and contrasts them against matched 1g controls. Simulated reduced gravity is achieved by clinorotation using the Fluid Processing Apparatus (FPA), a design that has been used over 4,000 times in space (including for several of the strains used in this project) as the culture vessel, which serves to facilitate the comparison of our data from the simulated environments to that produced in spaceflight by other groups. Future studies under this project include characterization of phenotypic traits (e.g. cell size), determining minimum inhibitory concentrations of four different classes of antimicrobials, and differential gene expression analyses under these four gravitational regimes. Knowledge produced from this project may help us better prepare for human space exploration and establishment of habitats on the Moon and Mars.

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