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THE INFLUENCE OF SPACEFLIGHT AND SIMULATED MICROGRAVITY ON BIOFILM FORMATION AND THE EXCHANGE OF GENES BETWEEN MICROORGANISMS.

Abstract

One of NASA's goals is to minimize the health risks associated with extended spaceflight, so it is critical that methods for preventing and treating spaceflight-induced illnesses be developed before astronauts embark upon long-duration space missions. Thus, it is important to understand how bacterial physiology that can impact human health, are affected by spaceflight, such a biofilm formation and horizontal gene transfer (HGT). This study, which has been funded by the NASA Space Biology program, will examine the exchange of antimicrobial genes between two relevant human associated opportunistic pathogens, *Acinetobacter pittii* and *Staphylococcus aureus*, when grown on the ISS, and in three commonly used simulated microgravity (SMG) devices on Earth- the rotating wall vessel, Gravite and the random positioning machine. Acquired antimicrobial resistance will be assessed through phenotypic analyses, and transfer of genes, through polymerase chain reaction and whole genome sequencing. The latter will also determine the transfer of other relevant genes, such as those involved in virulence and resistance to various spaceflight stressors. Biofilm formation of *S. aureus* (the same strains used to study HGT), will also be assessed, through confocal microscopy, transcriptomics, and metabolomics, when grown on the ISS and SMG devices on Earth. Planktonic cells from biofilm cultures will also be analyzed. Flight experiments on the ISS are scheduled for 2024, but preliminary work has shown increased HGT and biofilm formation under SMG compared to 1G. This study will provide insight into microbial adaptation of two spaceflight relevant bacterial properties, HGT and biofilm formation. Comparing the responses from the ISS with three popular and frequently used SMG devices on Earth, and verifying whether the same outcomes can be achieved, will allow more researchers to partake in space related microbiology and human microbiome work, without the extensive limitations imposed by conducting experiments on the ISS.