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DRUG DISCOVERY AND DEVELOPMENT IN SPACE

Abstract

Increases in bacterial proliferation, mutation rate, and virulence have been observed during spaceflight. Additionally, decreases in drug effectiveness and shelf life in space have also been documented. All of these factors conspire against astronaut's health during long-term missions. However, they also serve as a unique platform for drug discovery investigations. For example, the Antibiotic Effectiveness in Space-1 experiment conducted on-board the International Space Station (ISS), assessed phenotypic and genotypic changes on E. coli as higher concentrations of antibiotic were needed to inhibit its growth. This was done with a broader aim of identifying new targets for novel compounds in the fight against drug-resistance, a problem that is killing over 100,000 people a year worldwide. Similarly, the National Laboratory Pathfinder Vaccine experiment series (NLP-Vaccine), conducted on-board the Space Shuttle and ISS, included investigations to develop a vaccine against Salmonella. This has also been the objective of related experiments such as Micro-5, flown to ISS in 2015. These experiments have studied this problem from the host susceptibility, pathogen virulence, and host-pathogen interaction perspectives. Beyond bacterial studies, the Drug Metabolism experiment recently performed on ISS investigated the feasibility of repurposing metformin, a drug used for type 2 diabetes, as an anti-cancer agent. This is achieved, in part, by studying how drugs act on tumors using yeast cells as research models. The microgravity environment has also been used as a step in the development of drugs against osteoporosis, and muscular dystrophy. In summary, spaceflight is proving to be an effective environment for drug discovery and development efforts. However, the promise that the microgravity environment brings has not yet come to fruition fully, mainly due to lack of knowledge of the benefits it can provide.