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HARDWARE FOR CELL CULTURES IN SPACE

Abstract

Biological experiments in space require specialized hardware that will enable its operation as well as the protection of the astronauts. In terms of operations, one of the challenges is that the experiment must start in a controlled fashion, days and sometimes even months after the hardware has been turned over to the launch vehicle personnel. This is because the spacecraft needs to reach orbit, dock with the space station, and then await available crew time for operation. Additionally, safety protocols are in place to ensure the wellbeing of the astronauts and the space station. This translates into increased complexity on the hardware, as multiple levels of containment and risk mitigation protocols need to be put in place. To meet these objectives and enable biological experiments in space, the Fluid Processing Apparatus (FPA) was developed. To date, over 5000 of these spaceflight-rated test tubes have been operated on orbit on more than 40 separate missions, serving as a culture chamber for fungal, bacterial, and mammalian cells, among others. Experiments performed in FPAs have investigated virulence, antibiotic effectiveness, antifungal production, and vaccine development, through morphological, genomic, proteomic and transcriptomic post-flight analyses. Similarly, infectious processes have been conducted where *C. elegans* have been co-cultured with pathogenic bacteria, including *E. coli*, *Enterococcus faecalis*, *Listeria monocytogenes*, *Salmonella typhimurium*, or Methicillin-resistant *Staphilococcus aureus* (MRSA). Scientific results from selected experiments are here presented.