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IN SITU SPACE PROTEIN CRYSTAL GROWTH: A NEW APPROACH TO CONDUCTING PCG RESEARCH ON ISS

Abstract

There are several spaceflight-related limitations that can negatively impact the outcome of Protein Crystal Growth (PCG) research on the International Space Station (ISS). First, most spaceflight hardware is uniquely designed, requiring many months to perfect experiment protocols that will produce reliable results in that hardware. Second, samples and solutions often must be kept physically separated or refrigerated/frozen to prevent crystal growth from occurring on the ground before launch, which is not always standard practice for these experiments. Third, the experiments are usually launched and returned without the ability for feedback or adjustments during the flight. To address these limitations, the ISSPCG payload used unmodified and commonly used Commercial off the Shelf hardware to dramatically reduce the time and money spent readying the experiment for the ISS flight. Astronauts with little to no experience pipetting solutions watched brief instructional videos before the pipetting activities began and were walked through the procedures by ground support personnel. Real-time microscopic imaging was conducted to track experiment progress and protocol adjustments were made to maximize success. A total of nine multiwell plates were filled and imaged by astronauts during Increments 55-58. Hardware returned to earth for crystal harvest and the investigators reported that the overall process worked extremely well. The approach, results and lessons learned have applicability to a variety of other types of ISS experiments facing similar experiment design limitations.