

Protein Crystal Growth Research on the International Space Station: History and Future Opportunities

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The International Space Station National Lab (ISSNL) has sponsored and flown multiple Protein Crystal Growth (PCG) investigations to the International Space Station since 2014, with several more investigations and Request for Proposals (RFPs) in the queue. The ISSNL has aimed to reduce the lead time and costs associated with flying an experiment to the ISS. Historically, there have been several spaceflight-related limitations that can negatively impact the outcome of PCG investigations on the International Space Station (ISS). First, traditional 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. The ISSNL has demonstrated the use of unmodified and commonly used Commercial off the Shelf hardware to dramatically reduce the time and money spent readying a PCG experiment for an ISS flight. Investigators can send pre-filled PCG hardware to the ISS or rely on astronauts to load the samples into the hardware in microgravity. When necessary, real-time microscopic imaging can be conducted to monitor experiment progress. Protocol adjustments can be made while the experiment is still on ISS to maximize success. This approach, results and lessons learned have applicability to all users who are considering using the ISS as a platform for conducting their research.