Lessons learned from using the MiTeGen In Situ-1™ Crystallization Plate for microgravity protein crystallization

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The MiTeGen In Situ-1™ Crystallization Plate is a 96-well crystallization plate whose patented well design has enabled its use as a commercial technology for microgravity protein crystallization. Protein and precipitant reservoirs are physically separated except for a series of microchannels permitting vapor diffusion while strongly inhibiting fluid transfer. This design allows the plate to be safely rotated in any direction and makes the plate amenable for transport to and from the International Space Station (ISS). In their first flight demonstration in April 2016, crystals were observed in 90% of wells in five plates; fluid exchange was observed in less than 1% of wells. In 2018, a subsequent experiment provided an opportunity to evaluate a modular version of the In Situ-1™ Crystallization Plate while simultaneously exploring the ability of ISS crew members to assemble crystallization drops in microgravity. Crystals appeared in both versions of the plate; ISS crew overwhelmingly preferred the Modular In Situ-1™ Crystallization Plate due to its simpler design and ease of use. After return to Earth, the sealing films covering the Modular plates appeared inconsistently applied. Although there was no evidence of fluid exchange, many crystallization drops appeared partially dehydrated. This did not impact crystal diffraction, but it raised concerns regarding current plate sealing methods and which will be addressed in a third iteration of the plate. The In Situ-1™ Crystallization Plates are far from perfect, but the lessons learned from their use demonstrate them to be a robust, commercial alternative to more established microgravity protein crystal growth hardware.

Figure 1