

## On-orbit RNA Purification and qRT-PCR Capabilities of the WetLab-2 System

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NASA Ames Research Center's WetLab-2 system brings new capabilities to the ISS for researchers. The system can lyse cells and extract RNA on-orbit from different sample types ranging from microbial cultures to animal tissues. Our purification method has the advantage of using non-toxic chemicals and does not require alcohols or other organics. The purified RNA can then either be stabilized for return to Earth or can be used to conduct on-orbit quantitative Reverse Transcriptase PCR (qRT-PCR) analysis without the need for sample return. qRT-PCR reactions are performed by dispensing the RNA into reaction tubes that contain all lyophilized reagents needed to perform the analysis. The system uses a Cepheid® SmartCycler that allows for multiplexing of assays, this can be used to normalize for RNA concentration and integrity and to study multiple genes of interest in each tube. There are a total of 16 independent PCR modules each capable of detecting up to four fluorescent channels. The WetLab-2 system can downlink data from the ISS to the ground after a completed run and uplink new thermal cycling programs.

The ability to purify and stabilize RNA on-orbit can eliminate the confounding effects of reentry stresses and shock acting on live cells and organisms or the concern of RNA degradation of some samples. It also has the benefit of minimizing the needed downmass. Conducting qRT-PCR and generating results on-orbit is also an important step towards utilizing the ISS as a National Laboratory facility. Specifically, the ability to get on-orbit data will provide investigators with the opportunity to adjust experimental parameters in real time without the need for sample return and re-flight. On orbit gene expression analysis can also provide benchmarking prior to sample return. The system can also be used for analysis of air, surface, water, and clinical samples to monitor environmental pathogens and crew health.

The validation flight of the WetLab-2 system using *E. coli* bacteria and mouse liver is scheduled to launch on SpaceX-8 this spring. Pending operations, the preliminary results from the validation flight will be presented. To support the needs of future researchers, we are adapting our system to purify RNA from two additional sample types: fibrous tissue such as muscle and mammalian adherent cells grown on alginate beads. Progress of this work will also be presented.

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