Biomolecular Analysis Capability for Cellular and Omics Research on the International Space Station. Y. Guinart-Ramirez, V.M. Cooley, and J.E. Love. ISS Research Integration Office, NASA Johnson Space Center, Houston, TX, USA.

International Space Station (ISS) assembly complete ushered a new era focused on utilization of this state-of-the-art orbiting laboratory to advance science and technology research in a wide array of disciplines, with benefits to Earth and space exploration. ISS enabling capability for research in cellular and molecular biology includes equipment for *in situ*, on-orbit analysis of biomolecules. Applications of this growing capability range from biomedicine and biotechnology to the emerging field of Omics. For example, Biomolecule Sequencer is a space-based miniature DNA sequencer that provides nucleotide sequence data for entire samples, which may be used for purposes such as microorganism identification and astrobiology. It complements the use of WetLab-2 SmartCycler™, which extracts RNA and provides real-time quantitative gene expression data analysis from biospecimens sampled or cultured onboard the ISS, for downlink to ground investigators, with applications ranging from clinical tissue evaluation to multigenerational assessment of organismal alterations. And the Genes in Space-1 investigation, aimed at examining epigenetic changes, employs polymerase chain reaction to detect immune system alterations. In addition, an increasing assortment of tools to visualize the subcellular distribution of tagged macromolecules is becoming available onboard the ISS. For instance, the NASA LMM (Light Microscopy Module) is a flexible light microscopy imaging facility that enables imaging of physical and biological microscopic phenomena in microgravity. Another light microscopy system modified for use in space to image life sciences payloads is initially used by the Heart Cells investigation ("Effects of Microgravity on Stem Cell-Derived Cardiomyocytes for Human Cardiovascular Disease Modeling and Drug Discovery"). Also, the JAXA Microscope system can perform remotely controllable light, phase-contrast, and fluorescent observations. And upcoming confocal microscopy capability will allow for optical sectioning of biological tissues to determine microanatomical localization of biomarkers. Furthermore, NASA's geneLAB effort addresses integration of genomic, epigenomic, transcriptomic, proteomic and metabolomic datasets, by applying an innovative open source science platform for multi-investigator high throughput utilization of the ISS. In sum, the expanding ISS capability for analysis of biomolecules is enabling innovative research in a broad spectrum of areas such as cellular and molecular biology, biotechnology, tissue engineering, biomedicine, and Omics, providing manifold benefits for humanity.