Research from the NASA Twins Study and Omics in Support of Mars Missions

C. Kundrot[1], M. Shelhamer[1], G. Scott[2]

[1]Human Research Program, NASA, Houston, USA; [2]National Space Biomedical Research Institute, Houston, USA;

KEYWORDS: Mars, genome, omics

The NASA Twins Study, NASA's first foray into integrated omic studies in humans, illustrates how an integrated omics approach can be brought to bear on the challenges to human health and performance on a Mars mission. The NASA Twins Study involves US Astronaut Scott Kelly and his identical twin brother, Mark Kelly, a retired US Astronaut. No other opportunity to study a twin pair for a prolonged period with one subject in space and one on the ground is available for the foreseeable future. A team of 10 principal investigators are conducting the Twins Study, examining a very broad range of biological functions including the genome, epigenome, transcriptome, proteome, metabolome, gut microbiome, immunological response to vaccinations, indicators of atherosclerosis, physiological fluid shifts, and cognition. A novel aspect of the study is the integrated study of molecular, physiological, cognitive, and microbiological properties. Major sample and data collection from both subjects for this study began approximately six months before Scott Kelly's one year mission on the ISS, continue while Scott Kelly is in flight and will conclude approximately six months after his return to Earth. Mark Kelly will remain on Earth during this study, in a lifestyle unconstrained by this study, thereby providing a measure of normal variation in the properties being studied. An overview of initial results and the future plans will be described as well as the technological and ethical issues raised for spaceflight studies involving omics.