It is well known that extended spaceflight causes significant skeletal muscle atrophy in astronauts. However, the mechanisms that drive this process are not well understood. It is unknown how muscle tissues sense the microgravity environment leading to the muscle atrophy. We propose a product using miniaturized tissue-engineered skeletal muscle constructs to investigate the mechanisms behind skeletal muscle atrophy in microgravity.

Utilizing standard biology lab well plates, tissue-engineered skeletal muscle, a camera, an onboard computer system with necessary instrumentation, a means of electrically stimulating the muscle cells, and a stabilizer solution known as RNAlater, this product will allow muscle cells to undergo the process of atrophy while in a microgravity environment. The camera will acquire data during flight, yielding a visual of the muscles contracting and relaxing. The RNAlater will be injected into the muscle cell cultures while in microgravity to freeze their gene expression, allowing further investigation in a lab environment upon return to Earth. This product would be the first of its kind to provide an insight into the changing gene expression of muscle cells having atrophied in space.

The idea for this product came through a NASA program known as the Undergraduate Student Instrumentation Project (USIP). All team members for the HP competition are participating in this program, along with mentors in the Engineering and Biology departments at Ohio State University. What sets this product apart from the rest is that it will not only be designed, but also created in prototype form and test flown on a Blue Origin New Shephard suborbital flight in August 2017. That said, the real-world implications of this product are clearly defined, as its success will provide information never before obtained that can be utilized to improve the lives of astronauts for generations.