Research Report: Molecular Muscle Experiment
Uncovering molecular details related to muscle loss during spaceflight using *C. elegans* as a model organism

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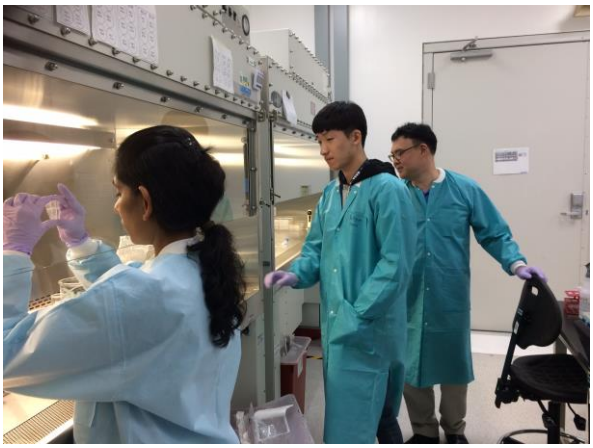
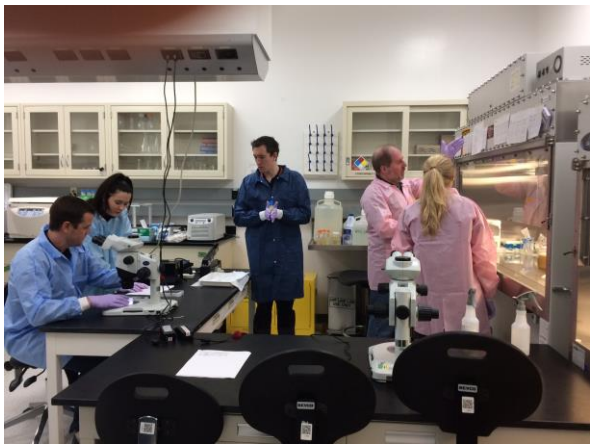
Loss in muscle mass is a common problem faced by astronauts in response to long duration space flight. Strenuous endurance training and exercise is required to maintain muscle mass in space. Similar results of muscle loss have been observed after spaceflight experiments when replicated using different animal models, like zebrafish, mice and worms, but the mechanism remains unknown. *C. elegans* is a great model system for studying muscle as there are exactly 95 muscle cells and the cell fate of each and every cell is well defined. Moreover absence of regeneration pathways makes it easy to study muscle degeneration in worms.

The current project "Molecular Muscle Experiment" aims to elucidate the molecular details of muscle loss or muscle degeneration pathways during spaceflight using wild type and various mutant (dopamine signaling mutants, touch mutants, mechanosensitive mutants) strains of *C. elegans*. The project was initiated and designed by the European Space Agency with Dr. Timothy Etheridge as principal investigator. This project demonstrates a global collaboration with scientific teams from UK, USA, Greece, Korea and Japan. From the Japan Team, headed by Prof. Atsushi Higashitani the aim is to elucidate the role of dopamine signaling in muscle related function and loss, so a variety of dopamine mutants have been used.

In the two weeks spent in a research lab at the Kennedy Space Centre, we prepared the samples (L1 worms) through alkaline bleach method. The eggs were placed in S-Basal-Gelatin coated 6-well plate in 1ml S-Basal solution. After 24 hours at 20° C, the hatched eggs were counted in triplicates and 50 L1 worms in 500 µl of S-Basal solution were placed (in quadruplets) in S-basal-gelatin coated 6-well plates. This plate was kept at 20° C for another 24 hours, after which the L1 worms were collected in 6 ml of OP50 or 2X Lab TIE medium in bags (82mm in length) and sealed. The bags were checked for possible breaks/tears by vacuum drying method for 30 mins, after which they were loaded on cartridges (3 bags/cartridge) and kept at 8° C for handover and loading onto the SpaceX CRS-16. The SpaceX successfully launched on 5th December and the samples will be cultured in ESA Columbus laboratory onboard the International Space Station for 6 days at 20° C. After sample return, we will study the effect of microgravity

on the levels of neurotransmitter dopamine and molecular physiological alterations in the space flown *C. elegans*.

(Sceneries in the KSC laboratory)

(Launch of SpaceX CRS-16 Falcon 9 rocket)