SSEP
Student Spaceflight Experiments Program

SSEP Mission 14 to ISS: Selected Flight Experiments, Communities, Teams, and Abstracts

Contact: Jeff Goldstein, SSEP National Program Director, 301-395-0770, jeffgoldstein@ncesse.org

A total of **3,076 proposals** were submitted from student teams across the 32 communities participating in Mission 14 to ISS. Of those **930 proposals** were forwarded for review by **Step 1 Review Boards** in each of the communities. Each Step 1 Review Board selected up to three finalist proposals, which were submitted to the **National SSEP Step 2 Review Board**. On December 1-2, 2019 the Step 2 Review Board met at the NASA Goddard Spaceflight Center's Visitor Center in Greenbelt, MD, reviewed all **97 finalist proposals**, and selected one proposed experiment to fly for 31 communities, 2 proposed experiments for one community, for a total of **33 flight experiments, 3 of which will fly on SpaceX-22**. It is noteworthy that the 3,076 proposals received reflected a total of **16,600 grade 5-16 students fully engaged in experiment design**.

1. Stamford, Connecticut

The Effect of Microgravity on the Ability of *Galloflavin*, in the Absence of Membrane Based Cellular Signaling Pathways, to Inhibit the Enzymatic Activity of *Lactate Dehydrogenase A*

Grade 12, Stamford High School
Co-Principal Investigators: Rithin Armstrong, Lizet Garcia
Teacher Facilitator: Sue Dougherty

Proposal Summary:
The investigation analyzes the inhibitory effect of *Galloflavin* on the tetrameric enzyme, *Lactate Dehydrogenase A.* Cellular respiration in humans is comprised of glycolysis, acetyl coenzyme A formation, the citric acid cycle, and oxidative phosphorylation. In aerobic conditions, cancer cells prefer metabolism via glycolysis rather than oxidative phosphorylation, which is the preference of most other cells of the body. This phenomenon is known as the Warburg Effect. Glycolysis is fueled by the nicotinamide adenine dinucleotide + obtained from the fermentation of pyruvate to lactate. Lactate dehydrogenase, the enzyme that catalyzes the conversion of pyruvate to lactate, plays an immense role in the processes leading to glycolysis and regulates the Warburg Effect. By inhibiting the enzymatic activity of *Lactate Dehydrogenase A*, we can disrupt aerobic glycolysis and decrease cell viability effectively across many cancer cell types. The investigation analyzes the effect of microgravity on the ability of *Galloflavin*, a lactate dehydrogenase inhibitor, to impair aerobic glycolysis and as a result inhibit the growth of cancer cells. *Galloflavin* has proven to inhibit the growth of endometrial cancer cells on Earth, however, very little is known about how *Galloflavin* and other potential inhibitors react in microgravity. Understanding the reactivity of these inhibitors in an acellular aerobic solution, in a microgravity environment, could be key to understanding more about whether *Galloflavin*'s potential effectiveness is independent of membrane based cell signaling pathways.

2. Bandera, Texas

Will the Growth of Brewer's Yeast be Affected in a Microgravity Environment?

Grade 6, Bandera Middle School
Co-Principal Investigators: Lillian D'Spain, Kylie Minton, Hailee Segura, Cassandra Steffler, Hannah Wells
Teacher Facilitator: Bette Koenig

Proposal Summary:
This investigation will aid recent advances in astronaut nutrition by exploring whether the growth of brewer's yeast is affected in a microgravity environment. This investigation will determine if two samples allowed to grow for a three-week period in different amounts of gravity vary developmentally.
This research is important for many reasons. The proper application of brewer's yeast through fermentation to foods grown in space may potentially allow astronauts to greatly extend the shelf life of these foods. This will make space missions less dependent on foods sourced from Earth. In addition, many foods fermented with brewer's yeast are known to have positive benefits to hair, skin, eyes, mouth, and your digestive tract. As NASA itself has said, "When crews venture further into space, traveling for months or years without resupply shipments, the vitamins in prepackaged form break down over time, which presents a problem for astronaut health". Fermentation may be a completely viable and innovative way to make foods last longer without causing damage to the vitamins that we derive from fruits and vegetables.

3. Lufkin, Texas

Can Radish Seeds Develop in Microgravity?

Grade 7, Lufkin Middle School
Co-Principal Investigators: Shariah Jackson, Patrick McGrew
Teacher Facilitator: Amy Rush

Proposal Summary:
Can radish seeds (*Raphanus raphanistrum*) develop in microgravity? If radish seeds can germinate in microgravity, then roots will emerge from the seed. Radishes are used for vitamins A, C, E, B6, and other minerals. They can also provide an immunity boost for the entire body, and are beneficial to the heart. Radishes are a healthy food source and can help astronauts keep up their nutrients. To address how well radish seeds will germinate in microgravity or whether they will germinate at all in this environment, radish seeds are placed in cotton. Water is applied to the seeds while on the ISS. The radish seeds will hopefully germinate in microgravity, and the length will exceed expectations. Polypropylene glycol is will be applied, stopping germination, before return to Earth.

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SSEP Mission 15 to ISS: Selected Flight Experiments, Communities, Teams, and Abstracts

Contact: Jeff Goldstein, SSEP National Program Director, 301-395-0770, jeffgoldstein@ncesse.org

A total of **485 proposals** were submitted from student teams across the 5 communities participating in Mission 15 to ISS. Of those **106 proposals** were forwarded for review by **Step 1 Review Boards** in each of the communities. Each Step 1 Review Board selected up to three finalist proposals, which were submitted to the **National SSEP Step 2 Review Board**. On December 11, 2020 the Step 2 Review Board met virtually, reviewed all **15 finalist proposals**, and selected one proposed experiment to fly for 5 participating communities for a total of **5 flight experiments, 2 of which will fly on SpaceX-22**. It is noteworthy that the 485 proposals received reflected a total of **1,700 grade 5-16 students fully engaged in experiment design**.

1. Moreno Valley, Connecticut

The Effects of Microgravity on Passion Fruit Seeds

Grades 11-12, Valley View High School
Co-Principal Investigators: Savannah Boehnke, Itzia Gutierrez-Gutierrez
Investigator: Randy Haley
Teacher Facilitator: Stacy Katzenstein

Proposal Summary:
In this experiment Passion Fruit seeds also known as *Passiflora edulis* will be sent aboard the ISS for observation on how microgravity will affect the Passion Fruit seeds, this will be the on-orbit experiment. While the on-orbit experiment is going on, there will be a ground-truth experiment. The importance of studying the Passion Fruit is due to the fruit not being well known or studied a great deal, this experiment will bring new data out about the Passion Fruit. This experiment will last between 4-6 weeks. Once the experiment has concluded, both the ground-truth and on-orbit experiments will be examined and reviewed to reveal how microgravity has affected the growth of the Passion Fruit seeds.

2. Burleson, Texas

The Effect of Microgravity on Cellular Regeneration of the Planarian Flatworm

Grade 6, Nick Kerr Middle School
Co-Principal Investigators: Camden Morton, Santiago Rios Ordonez, Levi Robinson, Miguel Ruiz, Brian Smith
Teacher Facilitator: Jonathan Hawley-Bernardez

Proposal Summary:
We are planning to do an experiment where we send an FME tube with planarian flatworms and formaldehyde inside the space station in microgravity to see if it affects the planarian worms' regeneration process. First we will cut the worms' heads off on Earth, then refrigerate the worms at 4 degrees so they go into hibernation and the stem cells, which are how the planarian

flatworms regenerate, don’t start the regeneration process. Our hypothesis is that since in microgravity there is a lessened force of gravity, it will let the planarian worms regenerate more freely, which means they will grow larger. The force of gravity on Earth is more powerful, so it will pull harder on the planarian flatworms, reducing their regeneration. In conclusion, we will be able to see the effects that microgravity has on the regeneration process of the planarian worms.