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-23**. 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. Redlands, California

Microgravity's Effect on the Germination and Early Growth of the Seeds of *Cymbopogon citratus*

Grades 10-11, Redlands High School
Principal Investigator: Maximilian Floridia
Co-Investigators: Evan Kusko, Ayesha Mirza, Anna Nguyen
Teacher Facilitator: Paul N. DeVoe

Proposal Summary:
This experiment assesses the effect of microgravity on the germination and early growth of the seeds of *Cymbopogon citratus* (the scientific name for lemongrass). Specific factors assessed are radicle orientation, germination rate, and root length. Not only will this help to validate and elaborate upon prior conclusions regarding the effect of microgravity on seed germination and early growth, but the results may also be analyzed to discern whether lemongrass overall is a viable plant in microgravity. Discussed extensively in both scientific and popular sources, lemongrass seeds and the mature plant itself are hardy, easy to grow, and tolerant to various adverse conditions, indicating that *Cymbopogon citratus* may be an economically logical plant to cultivate in the outer space environment. Additionally, researchers have demonstrated that its medicinal and practical applications are numerous, assuming important positions in the spheres of pharmacology and aromatherapy. These benefits become more attractive when the difficult conditions astronauts frequently encounter in microgravity are considered, with lemongrass potentially serving as a valuable resource for aiding the immune system, relieving psychological stress, and achieving necessary sanitation.

2. WNY STEM – Buffalo/Niagra, New York

The Effects of Microgravity on The Mating Habits of *Hypsibius Dujardini*

Grades 10-11, International Prepartory School at Grover
Co-Principal Investigators: Joseph Daniel Ruiz, Shyanne Cole Seiler, Saifullah Tayeb
Investigator: Imon Ahmend
Teacher Facilitator: Andrew Franz

Proposal Summary:
The investigation tests the impact of microgravity on the mating habits and reproduction of *Hypsibius dujardini* (tardigrades). Moreover, the investigating team is seeking to refine practices of culturing tardigrades in microgravity. If planetary travel is achieved, viable planetary scout organisms must be sent to the surface of these planets to begin terraforming and colonization. Being extremophiles, tardigrades may be able to be sent to the planet in tun state before a suitable biosphere has been established. If astronauts find that they have come out of tun state, maybe this is a signal that conditions are becoming right for all life. This is conjecture as technologies to quickly, efficiently, and cheaply travel to another planet are still in development, but it seems that parallel jumps in terraforming and space travel must be achieved if Mars really is a goal for humanity. Because of the adaptation ability and cryptobiosis of the tardigrade, it is a suitable “guinea pig” for being the first organisms to land on extraterrestrial soil. For analysis, sampling techniques are used to construct a growth curve of the *Hypsibius dujardini* culture.

3. Pittsburgh, Pennsylvania – University of Pittsburgh

Effects of Microgravity on the Oxidation of 3-D Printed Aluminum with Unique Topography

Grade 15, University of Pittsburgh, Swanson School of Engineering
Co-Principal Investigators: Marissa DeFallo, Nikolas Vostal
Teacher Facilitator: Dr. Sachin Velankar

Proposal Summary:
Aluminum alloys are used throughout the aerospace field, including aboard the International Space Station, due to its light weight and high strength properties. Aluminum corrodes when it is oxidized and forms a white powder-like substance on the surface of the material. In the presence of chlorides, such as salt, corrosion can tunnel through the aluminum and form pits which have a lower modulus and leave parts weakened. These corroded areas can lead to structural failures if they are not studied and prevented. One solution to prevent failure is by engineering surface textures to intentionally corrode sacrificial sections of a part. With recent advances in metallic 3-D printing it is easier than ever to create intricate aluminum parts with extreme precision. The importance of conducting this experiment in microgravity is because the force of gravity on earth trumps the surface tension of water at size scales exceeding a few millimeters. This will allow parts with large surface gradients to hold the salt water solution away from the main body, showing the effectiveness of different surfaces. This experiment will give insight into how aluminum corrodes in microgravity and provide useful data for creating corrosion-resistant aerospace parts in the future.

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, 3 of which will fly on SpaceX-23**. It is noteworthy that the 485 proposals received reflected a total of **1,700 grade 5-16 students fully engaged in experiment design**.

1. Hillsborough County, Florida

The Effect of a Microgravity Environment on the Germination Rates and Growth Development of German Chamomile (*Matricaria chamomilla*) Seeds

Grade 5, Sheehy Elementary School
Principal Investigator: Katherine Artia-Veliz
Co-Investigators: Moses Donaldson, Brianda Obispo-Polanco
Teacher Facilitator: Dr. Nebi Salim Bakare

Proposal Summary:
The purpose of this investigation is to explore the effect of a microgravity environment on the germination rates and growth development of German Chamomile (*Matricaria chamomilla*) seeds. Conducting this experiment in a microgravity environment and on Earth at the same time will help us observe and compare how many seeds germinated, the growth rate of germinated seeds and the root development of germinated seeds. This research is important, because when astronauts grow their own crops, it reduces the need for resupply missions. In addition, previous NASA research has shown that growing gardens in the International Space Station (ISS) can help keep astronauts happy and healthy on long missions in space. Although a variety of fruits and vegetables have been grown on the ISS, there is limited published research about growing herbs. German Chamomile is a medicinal herb that can provide both mental and physical health benefits. Growing and caring for chamomile plants can be a form of recreation for the astronauts, which can reduce stress. German Chamomile produces daisy-like flowers that release a sweet apple-like scent that can be enjoyed by the astronauts. The flowers can also be used to make tea, produce essential oils and create herbal remedies for many health problems, such as depression, insomnia, pain, digestive problems and inflammation.

2. Bandera, Texas

The Effects of Microgravity on Lavender Germination

Grade 6, Bandera Middle School

Co-Principal Investigators: Eva Le, Abigail Sizemore, Sydney Moore, Brianna Moore, Lilyann Cox

Teacher Facilitator: Bette Koenig, Kathleen Foster

Proposal Summary:

This experiment will determine the effect of microgravity on Lavender Germination. Lavender plants reward with pretty gray-green leaves that include a refreshing scent (American Meadows, 2020). The criteria for the lavender plant to germinate would be the lavender seeds (1), alkaline soil (this soil has the most beneficial pH for the lavender plant), and water (over pour will lead to plant death; only needs to be watered once or twice a week). The seeds will approximately take 14 days (2 weeks) to germinate (Ellis, 2020). Lavender is often used in aromatherapy. The fragrance from the oils of the lavender plant is believed to help increase calmness and wellness (The Simple Things, 2019). Additionally, it has helped reduce stress, anxiety and possibly even mild pain. NASA indicates that one of the top 5 largest hazards facing human spaceflight is the effect of isolation on astronauts' mental health, which lavender is a key remedy for (Mars, 2019).

3. iForward-Grantsburg, Wisconsin

If Grape Seeds were in Microgravity, Would they still be able to Germinate?

Grade 7, iForward Public Online Charter School

Co-Principal Investigators: Jill Guenther, Kaylie Mikle, Emmalynn Schoonover, Ava Tracey

Teacher Facilitator: Andrea Konrath

Proposal Summary:

In this project, the investigators hope to germinate concord grapes, or *Vitis labrusca*, in microgravity. Astronauts often have weak bones after going into space for long flights. According to a NASA article, "Many scientists believe that microgravity somehow causes bone to break down at a much faster rate than it is built up" (Dunbar). This is a major health concern. An astronaut's bones might get so fragile that they could fracture. *Vitis labrusca* provide many nutrients that are good for bone health, such as calcium, magnesium, phosphorus and more. If this project is successful, grapes could be grown in space and provide many nutrients to help with the health of astronauts. The investigators' hypothesis is, the grape seeds will germinate slower in microgravity than on Earth because the seeds will be without gravity and sunlight.