SSEP Mission 19 to ISS: Selected Flight Experiments, Communities, Teams, and Abstracts

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A total of **1,178 proposals** were submitted from student teams across the 20 communities participating in Mission 19 to ISS. Of those **397 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 3-4, 2024, the Step 2 Review Board met via Zoom, reviewed all **60 finalist proposals**, and selected one proposed experiment to fly for 19 communities, 2 proposed experiments for one community, for a total of **21 flight experiments, of which 20 experiments will fly on SpaceX-34 (Note: one M19 experiment will fly later this year)**. It is noteworthy that the 1,859 proposals received reflected a total of **7,288 grade 5-16 students fully engaged in experiment design**.

1. São Paulo, Brazil / Lisbon and Porto, Portugal
The Effect of Microgravity on the Osteogenic Potential of Mesenchymal Stem Cells Secretome
Grades 11-12, Escola Básica e Secundária Carolina Michaëlis, Porto, PortugalCo-Principal Co-Principal Investigators: Ana Beatriz Oliveira Gomes, João Paulo Machado Ribeiro, Laura Coimbra Cesário, Maria Rita Valongo Pinto, Mariana De Almeida Pinheiro, Rafael Silva
Teacher Facilitator: Elsa Alves

Proposal Summary:
Due to prolonged exposure to microgravity, astronauts suffer from health issues. Among these problems are muscle atrophy and bone density loss (1 to 2% per month, which results in approximately 20% per year), due to the reduced effort required for movement. Skeletal deconditioning, characterized by a significant reduction in bone density, increases the risk of fractures and osteoporosis, threatening the viability of long-duration missions and the astronaut's mobility upon returning to Earth. The secretome, a collection of molecules, including proteins, secreted by stem cells, plays a communicative role in the differentiation of precursor cells into osteoclasts and osteoblasts. Thus, the secretome contributes to the formation and resorption of bones carried out by osteoblasts and osteoclasts, respectively. In this experiment we intend to see if microgravity affects the osteogenic potential using secretome extracted from of mesenchymal stem cells (MSCs) from the periosteum of the palate.

2. Edmonton, Alberta, Canada
Will Soybeans Germinate in Space?
Grade 8, Michael Strembitsky School, Edmonton Public Schools
Co-Principal Investigators: Nash Fleming, Malakai Hall, Fielding Hoffmeier, Moumen Khellaf
Investigators: Declan Hansen, Oliver Miedreich, Ethan Pierson
Collaborator: Ivan Rasiak
Teacher Facilitator: Julie Arsenault

Proposal Summary:
The proposed investigation examines the growth of soybeans, Glycine max, specifically the lengths of their roots and stems, when grown on Earth compared to those grown in microgravity. The investigation will consist of a ground control FME tube and an FME tube sent to space. They will both be grown and measured simultaneously, with the hope that the soybeans in space will exhibit comparable or greater growth in root and stem length than those grown on Earth. If the soybean can successfully sprout in space, it will allow the production of plant-based products in space, which will support long-term human missions, contribute to sustainable life support systems, and provide fresh food sources for astronauts. The successful growth of soybeans in microgravity could lead to advancements in space agriculture, enhancing food security during extended space exploration and potentially enabling the development of regenerative life support systems. Additionally, it could open avenues for research into plant biology under different gravitational conditions, further expanding our understanding of plant growth and adaptation.

3. Guelph, Ontario, Canada
Brine Shrimps Reaction to Purple Sulfur Bacteria
Grade 8, Rickson Ridge Public School, Upper Grand District School Board
Co-Principal Investigators: Eman, Joseph, Samara
Teacher Facilitator: Mike Kumbhani

Proposal Summary:
The experiment will focus on whether or not the growth of the dormant brine shrimp eggs will speed up when it is met with 2.3 ml of saltwater that is mixed with 0.5 ml of purple sulfur bacteria while being in microgravity. The reason for the choice to test brine shrimp is because they have high nutritional value and are small enough to fit into the container that can easily be transported to space. Food is a necessity that no human can live without, and though brine shrimp is not commonly a part of the human diet, it is excellent to feed other things that may be a part of our diet like flamingos, birds, fish and other crustaceans. This will then improve our diets as well as the whole ecosystem as brine shrimp play a big part in how sea life expands. The experiment will begin with the dormant egg being released into the salt water, and then over the last few days, a 37% formalin and salt water solution will be mixed in with the salt water and the brine shrimp will stop its growth. After that, when the experiment is sent back to Earth it would be easier to see the effects of microgravity and if it had affected the growth of it differently. Finally, it would be compared to the experiment that was conducted on Earth.

4. Ukraine
Investigation of the Effect of Microgravity on Germination of Legume Plants
Grade 9, Taras Shevchenko Lyceum of Kropyvnytskyi City Council
Principal Investigator: Skliarevska Daria
Investigator: Ponomariova Kateryna
Teacher Facilitator: Liudmyla Yankova

Proposal Summary:
The experiment aims to study the impact of microgravity on the germination of Black turtle bean seed (*Phaseolus vulgaris*, family *Fabaceae*) on the International Space Station (ISS). Growing beans on board the space station is a promising direction that can provide astronauts with a microelement- and protein-rich food product during long missions. Black turtle beans have a meaty texture, high nutritional and proteins value, making them ideal candidates for space research. Another advantage of black turtle seed as an experimental subject is that its fruits are in the upper third are a source of zinc, and they provide about the same amount of zinc (about 2 milligrams) as 4 ounces of turkey or shrimp. Improved fat metabolism is another health benefit astronauts are likely to gain by including black beans in their space diet. The experimental conditions justify the choice of nutrient medium, namely Murashige & skoog medium including

vitamins, which ensures proper metabolism and growth of their root system and shoots in microgravity conditions. The experiment's results are expected to contribute to understanding plant adaptation to space conditions and growth direction.

5. Mesa, Arizona

Microgravity's Impact on In Vitro Tau Protein Aggregation

Grades 10 and 12, Red Mountain High School, Mesa Public Schools
Co-Principal Investigators: Kearan Gibbs, Avery Hamilton, Sereniti Johnson, Alexis Kelley, Elizabeth Miller
Collaborators: Will Bycott, Tamia Brooks, Dahlia Casillas, Autumn Feilen, Martin Medrano, Ariadne Urquiza Gardea
Teacher Facilitator: Nicole Gomez

Proposal Summary:
As of 2021, Alzheimer's Disease and other neurodegenerative diseases affect 6 million people in the United States alone, and 3 billion people globally. This number is predicted to double by 2050. The neurodegeneration that occurs in these diseases is in-part related to the formation of neurofibrillary tangles (NFTs) caused by tau protein polymerization. Analyzing how microgravity affects tau protein aggregation will not only bring awareness to any health risks astronauts may encounter as a result of their exposure to microgravity, but it could also inform us of newfound characteristics of tau and aid in the development of treatments for both astronauts and the general population. A preliminary test will first be conducted to determine which tau-411 P301L mutant (either phosphorylated or unphosphorylated) will produce the most morphologically accurate aggregations when induced with heparin. The chosen protein will then be prepared in two experiments: one experiment will be introduced to microgravity and one will act as a control on Earth and continue to be exposed to gravity. There will be another ground experiment using this same protein (tau-441 either phosphorylated or non-phosphorylated) but without the mutation. Analysis of any potential discrepant effects that the mutant may have on the aggregation will help eliminate experimental uncertainty. Upon return to earth, all experiments will be analyzed with negative stain electron microscopy. This will allow the aggregation structures to be compared. Through this analysis, insights may be gained to advance medical understandings of the characteristics of neurodegenerative diseases and how to combat them.

6. Colusa, California

Bioremediation in Microgravity: Harnessing Oil-Eating Bacteria for Environmental Restoration

Grade 11, Colusa High School, Colusa Unified School District
Principal Investigator: Madison Burtleson
Investigator: Emiliano Guzman
Principal Investigator: Alaina Torres, Caeden Agnew, Sophia Thompson
Teacher Facilitator: Benjamin Haney

Proposal Summary:
The proposed investigation will examine the effectiveness of oil-eating bacteria in microgravity, focusing on their potential applications in addressing oil spills in Ecuador due to oil production, which is located on the equator. To determine if the Bacteria *Bacillus subtilis* is eating the oil in microgravity, a gas chromatography will be used to show the before-and-after results of the chemical compounds conditions reaction to the microgravity. By utilizing mineral oils as a substitute for crude oil, this experiment aims to simulate the crude oil spills in Ecuador and conditions while exploring the bacteria's growth and degradation capabilities in a controlled environment. The research seeks to provide valuable insights into the behavior of these microorganisms, which are crucial for biological restoration efforts. Understanding how oileating bacteria function in space may lead to advancements in environmentally friendly cleanup technologies on Earth's equator where there is seen to have less gravity, offering natural

solutions to soil pollution challenges on the equator. The outcomes of this experiment have the potential to significantly benefit the environment by contributing to the development of sustainable methods for restoring ecosystems impacted by oil spills. By demonstrating the efficacy of these bacteria in degrading hydrocarbons, the study aims to foster a cleaner and safer Earth. This investigation addresses critical environmental challenges while enhancing our understanding of microbial life in unique settings. The findings could inform future biological restoration strategies and contribute to maintaining ecological balance in both terrestrial and extraterrestrial contexts. Ultimately, this research represents a proactive approach to environmental stewardship and the promotion of a healthier planet.

7. Glendora, California
Microgravity's Effects on *Artemia Salina* Nauplii Development
Grade 10, Glendora High School, Glendora Unified School District
Principal Investigator: John Han
Collaborators: Chloe Shih, Joshua Kim, Mei Flock
Teacher Facilitator: Rana El Yousef

Proposal Summary:
This investigation explores the effects of a microgravity environment on the development of brine shrimp, *Artemia Salina*, nauplii. *Artemia Salina* produces cysts that undergo cryptobiosis, remaining in a dormant state until environmental conditions are suitable for hatching, making this organism ideal for a controlled biological experiment aboard the ISS. By sending *Artemia Salina* cysts to space, this experiment aims to evaluate the extent of microgravity's impact on this organism's early-stage development, focusing on the occurrence and likelihood of potential developmental anomalies. Understanding *Artemia Salina* growth in space is crucial, as it serves as a model for studying biological challenges and differences organisms may face during spaceflight. Because mankind's ambitions for long-term space missions necessitate sustainable biological systems for agriculture and aquaculture, any increase in birth defects or developmental delays would signal risks for potential organismic maturation in similar space environments – especially for *Artemia Salina*'s fellow brachiopods and aquatic life. Comparing the rate and types of birth defects with those seen in Earth-based controls will allow the analysis of specific developmental impacts of microgravity. Findings would advance scientific understanding of aquaculture and developmental biology in the context of space travel, contributing to the design of sustainable and practical life-support systems for long-term missions.

8. Colorado Springs, Colorado
Fungal Bioleaching in Microgravity: Fungal Approaches to Metal Recovery
Grade 14-16, University of Colorado Colorado Springs and Pikes Peak State College
Principal Investigator: Joseph Bate
Investigators: Tristan Dwyer, Cody Leeper, Evan Martin, William Shimel
Teacher Facilitator: Carol McClelland

Proposal Summary:
The proposed spaceflight experiment will investigate microgravity effects on the mycological processes of Bioleaching. Fungi are extremely versatile and resilient life-forms that are utilized in removing and recycling heavy metals from electronic components. These processes must be considered for use when designing off-world habitats as they can provide a means for recovering heavy metals for in situ resource utilization. This experiment will be conducted by hydrating freeze-dried Aspergillus niger spores suspended in a potato dextrose agar (PDA) compound allowing for the culture to germinate. A. niger will utilize PDA as an energy source allowing for the fungi to grow into a biomass. (nickel oxide) contained within calcium alginate gel will be introduced to the fungi. Through Bioleaching, the biofilm will act as a chelating agent, secreting citric and oxalic acid lowering the localized pH allowing for the dissolution of into nickel

ions [2+]. The cell walls of A. niger contain negatively charged carboxyl and hydroxyl groups that will readily bind to the positively charged [2+] which will be sequestered within the fungi vacuoles. The purpose of this experiment is to investigate the efficiency of A. niger in Bioleaching under microgravity conditions comparative to Earth. By analyzing parameters such as [2+] concentration, acid production, fungal growth morphology, and [2+] adsorption onto fungal biomass, the experiment aims to determine how low-gravity conditions affect the fungus's metal-leaching efficiency. An increase in [2+] adsorption is anticipated, which could further advance metal recovery techniques and support sustainable resource utilization in extraterrestrial environments.

9. Hillsborough County, Florida

Production of Mung Beans i.e., *Vigna radiata* in Microgravity

Grades 6-7, Randall Middle School, Hillsborough County Public Schools
Co-Principal Investigators: Platon Drozdov, Grayson Jones, Shravan Karthick
Teacher Facilitator: Dr. Lori Bradner

Proposal Summary:
The purpose of this investigation is to explore the effect of a microgravity environment on the germination rates and growth development of Mung Bean (*Vigna radiata*) seeds and whether they are an efficient food source in space. 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, as well as the nutritional value of the plant. This research is important because on long space missions, it is not feasible to take all the food from Earth, and growing crops in space reduces the need for resupply missions. Mung beans are especially well suited to being produced on the ISS because they have a short germination time of 4 to 5 days. Mung beans might be an incredibly beneficial plant to grow in space because they germinate and develop quickly, they are high in carbohydrates, protein, vitamins, antioxidants, and minerals, as well as having anti-diabetic, anti-inflammatory, and anti-cancer properties. Growing mung beans would ensure the health and well-being of astronauts. The investigation will use a mini lab with two clamps, with spring water in the first section, mung beans in the second section, and a fixative in the third section.

10. Pittsfield, Massachusetts

The Impact of Gravity on Cellular Metabolism in *Escherichia coli*

Grade 14, Berkshire Community College
Principal Investigator: Deaux Thibodeaux
Teacher Facilitators: Linden Crane and Colin Wilson

Proposal Summary:
This experiment aims to investigate how gravity affects cellular metabolism by examining the glucose fermentation efficiency of *Escherichia coli* (*E. coli*) under Earth's gravity compared to microgravity conditions. Initiated after learning about the Student Spaceflight Experiment Program (SSEP) in 2023 and presented at two Massachusetts academic conferences in 2024, the experiment seeks to contribute to the understanding of metabolic processes in microgravity environments. Prior research indicates that microgravity can disrupt cellular function, with both astronauts and animal models exhibiting systemic cellular dysfunction linked to metabolic breakdown in space. However, metabolic processes appear to have been less extensively studied compared to other microgravity-related issues. Understanding microgravity's impact on cellular metabolism may help advance astronaut focused healthcare, as metabolic dysfunctions in space can affect muscle, bone, cardiovascular health, and potentially other physiological systems. By assessing the glucose fermentation efficiency of *E. coli* in microgravity, this investigation may provide insights into how gravity influences cellular metabolic pathways. The

findings could potentially contribute to furthering healthcare for individuals working in microgravity environments.

11. Albany, New York

The Effect of Microgravity on *Mentha piperita*

Grade 8, William S. Hackett Middle School, Albany City School District
Co-Principal Investigators: Grace Fruehwirth, Naomi Richards, Simone Schou
Teacher Facilitator: Allison Sheehan

Proposal Summary:
This experiment aims to figure out how microgravity affects the growth of *Mentha piperita*. *Mentha piperita* (or mint) can be used in many different ways. *Mentha piperita* leaves can be a remedy for the common cold, and inflammation, can help heal the liver, and can also help disorders in the gastrointestinal tract like nausea, vomiting, diarrhea, cramps, flatulence, and dyspepsia. The hypothesis is that if *Mentha piperita* is sent to the ISS, the number of seed that will germinate in microgravity would increase compared to Earth. This experiment could be set on Earth and the ISS because it's common knowledge that mint grows on Earth so we want to see if it adapts differently in microgravity.

12. Long Beach, New York

The Effect of Microgravity on the Germination of Microgreen Seeds

Grade 6, Long Beach Middle School, Long Beach Public Schools
Principal Investigator: James Quintanilla
Investigator: Kai Ortsman
Collaborators: Henry Chambers, Lucas Onufrock
Teacher Facilitators: Natasha Nurse, Cristie Tursi

Proposal Summary:
The group is researching "How does microgravity affect the germination of Microgreen Seeds?" This study is crucial for future space missions as microgreens are young plants harvested for their high nutritional value. They grow quickly, require minimal equipment, and provide concentrated nutrients vital for astronauts facing health challenges in microgravity, such as weakened immune systems and limited medical care. Fresh, nutrient-dense foods could be essential in supporting astronaut health during long missions. In space, plant growth changes significantly due to microgravity. With very little gravity, water, air, and nutrients behave differently compared to Earth. For example, water does not "fall" through the soil, making it harder for plants to absorb water efficiently. Additionally, microgreens cannot easily sense up from down, which could result in longer stems and smaller roots, affecting their ability to access nutrients, store energy, and interact with beneficial bacteria. Understanding how microgreens grow in space is key to developing life support systems for long-duration missions. Fresh plants could provide astronauts with the necessary nutrition, oxygen, and moisture in the closed environments of spacecraft. Researching optimal conditions for microgreen growth can help design sustainable food production systems for missions to Mars, where resupplying food from Earth is challenging. Furthermore, microgreens may serve as a model for growing other nutrient-rich plants in space, offering health benefits beyond basic nutrition. By studying microgreens in microgravity, the team aims to create a reliable method for supporting astronaut health on extended journeys

13. Athens, Ohio

Effect of Microgravity on Growth of Watercress: a Promising Space Food

Undergraduate, Ohio University
Co-Principal Investigators: Lara Fogwell, Cat Gavin
Collaborator: Jake Magula
Teacher Facilitator: Leo Perez

Proposal Summary:
Duckweeds belong to the monocotyledon family Lemnaceae, a family of floating aquatic plants. One species in the Lemnaceae family, *Lemna minor*, is a relatively simple plant to cultivate due to its small size and rapid growth rate. Since duckweed is edible and fast growing, it is a promising potential food source for personnel in space travel. For the proposed experiment, three Fluids Mixing Enclosure (FME) Mini-laboratories, containing *Lemna minor* seeds, will be run simultaneously. They will be kept in different conditions: spaceflight, Earth gravity, and a clinostat, which simulates the effects of microgravity. The seeds in the FME Mini-labs will be germinated in water and later exposed to a fixative before leaving their respective experimental conditions. This allows for consistent growth periods and isolates the effect of growth conditions. Germination rates and starch content will be measured and compared between groups. This experiment will investigate the effects of spaceflight on *Lemna minor*'s germination and how this species can grow and adapt to microgravity in a limited, enclosed space. When exposed to microgravity conditions aboard the International Space Station as well as simulated microgravity conditions in a clinostat, *Lemna minor* is hypothesized to have germination success rates comparable to Earth gravity conditions. The growth rates of duckweed in spaceflight and simulated microgravity are expected to be higher than those observed in Earth gravity. Additionally, it is anticipated that the starch content of *Lemna minor* grown in spaceflight and simulated microgravity will increase compared to *Lemna minor* grown in Earth gravity.

14. Pickerington, Ohio
The Effect of Microgravity on Antibacterial Hand Sanitizer
Grade 6, Toll Gate Middle School, Pickerington Local School District
Co-Principal Investigators: Soliyanna Richards, Addalyn Bolon, Lia Knight
Teacher Facilitators: Kristie VanKannel, Anna Meyer

Proposal Summary:
The purpose of this experiment is to see if antibacterial hand sanitizer kills bacteria at the same rate it does on Earth. Scientists want to know if antibacterial products, like the ones we use at home, work the same way in space. Will they kill germs as well in microgravity? To find out, we're going to send an experiment to the International Space Station (ISS). We will test 70% alcohol based antibacterial hand sanitizer such as Purell, to see if it can kill an *E.Coli* sample at the same rate on the ISS as on our Earth. We think that the antibacterial products might not work as well in microgravity. The lack of gravity might affect how the chemicals in the products work. If we find out that these products work well in space, it could help keep astronauts safe from germs and help with medical needs.

15. Pittsburgh, Pennsylvania - CCAC
The Effects of Microgravity on the Quantitative Measurements of Calcite Crystals
Grade 13, Community College of Allegheny County
Co-Principal Investigators: Arianna Swearman, Ashley Pfeffercorn
Teacher Facilitator: John Float

Proposal Summary:
Understanding the effects of microgravity within the human body is essential due to how the body responds in the absence of gravity. Calcite structures in the inner ear, formed from calcium carbonate, known as otoconia, help maintain balance by sending critical signals to the brain that control head and body movement. In microgravity, these structures can become disoriented, impairing an astronaut's sense of balance and spatial awareness. Upon returning to normal gravity, the body gradually readjusts, but effects on balance and orientation may persist. This research seeks to reveal how extended space missions might impact astronauts' ability to maintain posture, balance, and spatial orientation. As agencies prepare for prolonged missions to planets with varying gravitational forces and potentially hazardous environments.

Understanding the role of otoconia within space could help counteract disorientation, reduce vertigo, and ensure astronaut safety on long-term missions where gravity and environmental stability is unstable. The primary goal is to explore the effects of microgravity on the human body, specifically focusing on the role of calcite crystals in the inner ear. While calcite is essential in human physiology, calcium carbonate also plays a significant role in ecosystems and scientific research. In fact, calcium carbonate is involved in various biological processes, and its behavior in microgravity could reveal crucial insights into how gravity influences life on Earth. By understanding how microgravity impacts these crystals, this research offers important insights into how gravity influences biological and environmental systems, yielding knowledge relevant for both space exploration and for life on Earth.

16. Plano, Texas
Capillary Action within *Crassula ovata* (jade plant) Leaf Cells in Microgravity
Grades 10 and 12, Plano ISD Academy High School, Plano Independent School District
Co-Principal Investigators: Adeena Nasir, Camille Juliet Hatfield
Teacher Facilitator: Tina Cone

Proposal Summary:
Water is essential for all known life, and its properties can be significantly altered under microgravity. This investigation will explore how microgravity affects capillary action, a critical process for water transport in plant structures. While capillary action has been studied in space, its role in plant cell function under microgravity remains mostly unexplored. To test this, a cutting of a succulent plant will be placed between dyed water and ethanol concentration, so that when the experiment is in progress the results/ the distance the water travels can be measured. The ethanol is used to preserve the results of the experiment for observation. Understanding how this process behaves in space is vital to determining whether plants can grow and receive water efficiently in long-duration space missions. This investigation aims to provide insights into whether current Earth-based expectations for water usage in space agriculture need to be adjusted to ensure successful crop growth, and hopefully serve the decision process needed when trying to achieve NASA’s long-term goal of starting a colony in space.

17. San Antonio, Texas
Microgravity Effect on the Corrosion Rates of Iron and Aluminum
Grade 8, Space and Engineering Technologies Academy, North East Independent School District
Principal Investigator: Hazelrose Fullylove
Investigators: Isabelle Mora, Kinley Mosley, Luna Yamaguchi
Teacher Facilitator: Edwin Guerra

Proposal Summary:
This project will test the corrosion rates of iron and aluminum in microgravity. This project will be able to show the rates at which iron and aluminum corrode in microgravity. This will help choose which metals should be used in microgravity, or in later settlements in space because it provides insight on how quickly or slowly the metal will corrode in these types of environments. This will be helpful in future settlements in space as with the knowledge of the metals corrosion rates and their properties, people can make better decisions on their choice of metal when designing structures for these settlements. This will prevent their buildings, tools, and other structures built not to corrode and fall apart. This project will help as without this knowledge people may design and build things unaware of their properties in their environment, possibly causing trouble in construction or after it has been constructed and it starts to fall apart which could cause multiple problems. The hypothesis is that corrosion will accelerate in microgravity.

18. Texarkana, Texas
Can Mold Grow in Microgravity?
Grade 7, Texas Middle School, Texarkana Independent School District
Co-Principal Investigators: Rhett Simpson, Sam McGinnis
Investigator: James Williams
Collaborator: Logan Morris
Teacher Facilitator: Nicole Ayers

Proposal Summary:
The question is, “Can Mold Grow in Microgravity?” Mold is important because it can be turned into penicillin, a common medicine for practically anything. Foods such as bread grow mold rather quickly. If astronauts can turn mold into medicine it could help further space safety. The investigation will hopefully grow mold spores on the bread. A mold spore is needed to produce mold. First, a piece of fresh bread will be put into the Type 2 FME Mini-Lab tube. Water will also be placed in the tube on the other side of a clamp. Once the clamp is released, water will get on the bread to promote mold growth. If the mold can be grown, this may determine if other types of mold can be grown in space that can be used for many beneficial reasons. Certain types of mold, such as penicillin, can be used to make antibiotic medicine. If penicillin can be made in space, astronauts and future space colonists can treat infections caused by common Earthly bacteria. This is why people need to know if mold can be grown in microgravity.

19. Waxahachie, Texas
Growing Strawberries in Microgravity
Grade 6, Eddie Finley Junior High School, Waxahachie Independent School District
Co-Principal Investigators: Lucas Brooks, Kellan Johnston, Raegan Trice, Dakota Weir
Teacher Facilitator: Theresa Smithey

Proposal Summary:
This investigation will explore strawberry seed growth in microgravity for a period of time. We think it would be helpful to grow strawberries in microgravity. One benefit is growing strawberries in space, and it has vitamins, like vitamin C, which can help you grow stronger and recover faster. It’s also a good source of food. Another benefit is growing strawberries can help the air in the space shuttle. We would like to use an FME 3 tube and put soil and strawberry seeds in the middle for the main experiment, Tur organic fertilizer, and water to help the strawberry seeds grow. We think if we could test if strawberries can grow in microgravity, then it would help a lot of food problems. One way it could help is that strawberries can give us nutrients and vitamins.

20. iForward-Grantsburg, Wisconsin
Sunflower Seeds in Microgravity: This Study will Determine if Sunflower Seeds can
Germinate in Microgravity and if it can Affect their Health Benefits.
Grade 7, iForward Public Online Charter School, Grantsburg, Wisconsin School District
Co-Principal Investigators: Summer Heiman, D’Vontae Jackson, Wyatt Kincaid, Neveah Mashak, Audrey Stillman, Camren Summers, Lilyona Wallberg
Teacher Facilitator: Laura Kavajecz

Proposal Summary:
The group’s essential question is “Will sunflower seeds correctly germinate in microgravity?”. The group will use a type 3 FME tube and 3 sunflower seeds for the procedure, put ½ tablespoon of water and 1½ tablespoons of dirt, and have the third chamber contain 2.5mL of formalin. The reason this is getting tested is so astronauts have another beneficial and substantial source of vitamins for space travel. To tell the difference, the group will compare the sunflower grown in microgravity to the one grown on Earth. This will tell The group if microgravity plays a role in the germination process of sunflower seeds or if microgravity does

not. Sunflower seeds give many benefits, such as Vitamin E, and B Vitamins, and nutrients that can help fight cancer. With all of these substantial benefits of sunflower seeds, and healthy fats, this can be a considerable source of all these nutrients for astronauts and future space. cite. This study's main experiment is to see if sunflowers germinate. This study hopes that the experiment will be successful because sunflowers give astronauts vitamin E and Vitamin B which is important for astronauts' health and well-being. This experiment uses a type 3 FME tube and 3 sunflower seeds for the procedure, and ½ tablespoon of water, 1½ tablespoons of dirt, and 2.5 mL of formalin.

The Student Spaceflight Experiments Program (SSEP) is a program of the National Center for Earth and Space Science Education (NCESSE) in the U.S. and the Arthur C. Clarke Institute for Space Education internationally. It is enabled through a strategic partnership with Nanoracks, LLC, which is working with NASA under a Space Act Agreement as part of the utilization of the International Space Station as a National Laboratory. SSEP is the first pre- college STEM education program that is both a U.S. national initiative and implemented as an on-orbit commercial space venture.

The Center for the Advancement of Science in Space (CASIS) is a U.S. National Partner on the Student Spaceflight Experiments Program.