SSEP Mission 11 to ISS Selected Flight Experiments
Communities, Teams, and Abstracts

SSEP *America* Experiments Payload
Launching on SpaceX-12, Kennedy Space Center, Florida

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

1. Coquitlam, British Columbia, Canada

The Effect of Microgravity on Fly-Ash Concrete used in Building Structures

Grade 12
Riverside Secondary School, Coquitlam School District 43

Co-Principal Investigators: Alexa Durand, Brenda Shen

Teacher Facilitator: Devon Ross

Proposal Summary: Concrete is the most widely used building material and thus would have many applications in microgravity (Chemistry World, 2008). From building foundations to roads, concrete can be found almost anywhere and has the ability to be even more useful than it already is. We propose an experiment to study the effect of microgravity on concrete, specifically concrete created using a mixture based on fly ash. The use of fly ash in a concrete mix reduces the amount of Portland Cement, dramatically cutting the cost as the material is a byproduct of coal production and does not need to be specifically made for concrete (NPCA, 2010). According to the National Precast Concrete Association (2010), fly ash also has many other benefits including greater strength over time, increased durability and increased workability. These benefits alongside the eco-friendly aspects make fly ash the best choice (NPCA, 2010). While small amounts of fly ash are used in most concretes, it generally does not exceed 30%, because of the long curing rate and the need for additional air entraining admixtures (Kompauer, 2016). We would like to test microgravity's effect on the strength, the durability and the drawbacks previously mentioned. If this experiment shows that fly ash concrete can have greater strength with its drawbacks negated, it would allow for a greater amount of fly ash to be used and help shift the world into a more eco-friendly direction. This also allows for fly ash concrete to be used for constructing infrastructures in microgravity settings.

2. Stonewall, Manitoba, Canada

Can Tomatosphere™ tomato seeds germinate on Earth after having been exposed to microgravity and cosmic radiation for a second time of exposure?

Grade 8
Ecole Stonewall Centennial School, Interlake School District

Co-Principal Investigators: Carter Ives, Graeme Perrie, Adam Stamler

Teacher Facilitator: Maria Nickel

Proposal Summary: Our proposal is to see if the Tomatosphere™, seeds (which have previously been exposed to microgravity and cosmic radiation environment along with entering and exiting Earth's atmosphere) will grow on Earth after being re-exposed for a second time to similar conditions on board the ISS (International Space Station). This has not been done before with the Tomatosphere™, a second exposure. We chose the Tomatosphere™ seeds due Grade seven science class when we grew them in the spring of 2016 . We would like the experiment to be conducted to see if the growth rate and size of the tomato plant changes due to these environmental changes. We also chose this experiment to expand our knowledge about astronaut health, space agriculture, deep space exploration and habitation on Mars or other planets. We want to learn from our experiment if astronauts and regular humans are to ever perform interstellar travel and colonize multiple planets, if the increased cosmic radiation exposure will improve or not improve upon nutritious food production. This has large applications for nutritious food production on Earth and in space. Our question is Can Tomatosphere™ tomato seeds germinate on Earth after having been exposed to microgravity and cosmic radiation for a second time of exposure? Our hypothesis is that the Tomatosphere™ seeds from space for the second time, will germinate taller and larger plants. As well, they will germinate faster than the ground truth Tomatosphere™ seeds that have not been exposed to those same conditions.

3. iLEAD Consortium, California

Microgravity and Yeast

Grade 6
iLEAD Pacoima, iLEAD Charter Schools

Co-Principal Investigators: Auguste Bacchus, Daniel Herrera, Jack Sidman, Alexii Villamar

Teacher Facilitator: Jacob Drori

Proposal Summary: Our group is intending to discover how fast *S. cerevisiae* grow differently in microgravity than on Earth. Yeast is a simple organism that feeds on things like sugar mixed with water and it produces $CO2$. Yeast is a fungus used for cooking foods like bread, dough, and alcohol. Yeast has B vitamins and those vitamins help your body convert carbohydrates and fats into protein and energy. Yeast reproduce asexually by budding. Budding is when a parent yeast cell begins to grow, so when the parent cell gets bigger the parent cell's nucleus divides into two. One of these nuclei transfers into another growing bud, which eventually pinches off and the process repeats. We developed this idea because one of the people in our group thought about yeast, because his father is a chef, and his father had a list about how to make pizza dough, which of course has yeast. We hope to learn if yeast will bud faster in space than on earth due to microgravity. Yeast could be used to make food in space instead of having to bring all of it when leaving earth. This is especially true of foods like bread which won't typically last long.

4. North Hollywood, California

Hydroponics in Microgravity

Grade 8
Oakwood School

Co-Principal Investigators: Finn Flackett-Levin, Koa Lee, Noah Mack

Teacher Facilitator: Melanie Magdaleno

Proposal Summary: In our experiment, we plan on figuring out what effect gravity, or rather the lack of gravity, has on the amount of root hairs grown on plant roots. Plant roots play a major role of getting nutrients from the outside of the plant to the insides, which would then help it grow. We will be germinating lettuce hydroponically, because hydroponics are easier to manage in microgravity than normal soil, and lettuce grows easily in hydroponic environments. We will be using 2.5 – 2.8 ml of the nutrient solution per volume, and we will also be using 3 lettuce seeds. In volume 1, we will place the lettuce seeds, and in volumes 2 and 3 we will put the hydroponic nutrient solution. We will simultaneously be conducting this experiment on earth as a control within the effect of gravity. When the experiment returns to earth, we will examine both of the germinated seeds under a microscope to count the differences in the number of root hairs both seeds have. The knowledge we gain from this will help us in the near future if and when we need to grow food on longer space missions.

5. Santa Monica, California

The Effect of Microgravity on the Rate of Fermentation In Saccharomyces cerevisiae

Grade 8
Lincoln Middle School, Santa Monica Malibu Unified School District

Co-Principal Investigators: Alexander Chopra, Kenneth Christmas III, Zachary Jacobs, Samuel Kohn, Noah Sakkour

Teacher Facilitator: Carol Wrabel, Gretchen Gies-McLaughlin

Proposal Summary: The question being proposed is whether or not microgravity on the International Space Station affects the quantity of ethanol produced from yeast fermentation compared to the amount produced on Earth. Fermentation is a process in which a sugar solution containing yeast as catalyst is turned into alcohol (ethanol) (GCSE CHEMISTRY). With ethanol being a cleaner energy source, it could cut down on pollution leading to cleaner atmospheres. This experiment could raise the possibility of using yeast as a catalyst for rocket fuel or as an energy source during space expeditions. To answer the question, the experiment must be tested in the Fluids Mixing Enclosure (FME) while on the International Space Station's microgravity atmosphere. The contents of the first and second sections of the FME tube include the yeast (*Saccharomyces cerevisiae*), and the solution of Wyeast Nutrient Blend, dextrose (corn sugar), mixed with distilled water. The third and final section of the FME tube contains sea salt. The yeast and the solution will be mixed and the sugar will allow the yeast to ferment and the nutrients will allow for the yeast to survive. After two days, the third section will be unclamped allowing for the salt to kill off the yeast and stop the fermentation process. The amount of ethanol produced will then be measured. Being able to produce ethanol more efficiently in the microgravity environment could allow the use of ethanol as an alternative, less costly, and more efficient fuel source that could enhance future space exploration.

6. Vista, California

Can Dugesia japonica Regenerate in Microgravity through the Use of Stem Cells?

Grades 6-8
Vista Magnet Middle School, Vista Unified School District

Principal Investigator: Evie Currington

Co-Investigators: Isabella Ansell, Isabel Camacho, Charlotte Currington, Sydney Wagner

Teacher Facilitator: Stephanie Sanchez, Sam Stavis, Christine Bartee

Proposal Summary: Our question is 'Can *Dugesia japonica* planarian worms regenerate heads while in microgravity through the use of stem cells?' We will send ten *Dugesia japonica* tails into space. Our objective is to compare the regeneration of *Dugesia japonica* on Earth to their regeneration in microgravity. Since *Dugesia japonica* regenerate, scientists can look into how they regenerate and in the future find out how to regenerate human body parts. We will quantify the size and the number of eyes and the head development for the two auricles (the tips on the sides of the head) and both light sensing eye spots called ocelli. Our hypothesis is if we send ten *Dugesia japonica* tails into microgravity, then the planarian worms will not regenerate because the stem cells in the *Dugesia japonica* will be affected. If the *Dugesia japonica* fully regenerate, then in the future scientists might be able to regenerate astronauts' bone structure or muscle mass while they are on the ISS.

7. Bridgeport, Connecticut

Microgravity's Effect on Immune System Response of Model Species: an Interaction between Daphnia magna and Pseudomonas aeruginose

Grade 12
Aerospace & Hydrospace Engineering School at the Fairchild Wheeler Campus, Bridgeport Public Schools

Co-Principal Investigators: Kiana Laude, Raysa Leguizamon, Jucar Lopes, Uchenna Oguagha

Teacher Facilitator: Lucas Fatsy, Zachary Garoffolo, Cliffton Price

Proposal Summary: With the expansion of space exploration, living in outer space is no longer a dream. Even though there has been ground breaking research, there are still many unknowns that are essential to living successfully in outer space. The effect of microgravity on the human immune system response is currently unknown. After astronauts have been exposed to microgravity for long periods of time, their immune system does not generate the appropriate responses to threats. This project will explain the interaction between the immune system of *Daphnia magna* and the bacteria *Pseudomonas aeruginosa* in a microgravity environment. The experiment will take place aboard the International Space Station (ISS). Since this experiment contains a BSL level 2 bacteria, all preparations will occur in a BSL level two certified laboratory. The *D. magn* will be exposed to the bacteria for 3 days in space before being sent back to Earth for testing. The hemolymph of the *D. magna* will be tested for a change in the protein levels prior to the space experiment and after the experiment has returned to Earth. These results will give insight to how microgravity influences the interaction between bacteria and the immune system.

8. East Hartford, Connecticut

How does Microgravity Affect Algae Growth?

Grade 8
CREC Two Rivers Magnet Middle School, Capitol Region Education Council (CREC)

Co-Principal Investigators: Kassidy Gagnon, Jack McCann, Andrew Niemczyk, Angel Soto, Kieran Yanaway

Teacher Facilitator: Kennan Poulakos

Proposal Summary: We are investigating whether algae growth is affected by microgravity. We believe that algae will not be affected in microgravity. The conditions of algae growing would not be considerably changed, as microgravity would simply result in floating globules of algae. This information will be imperative to future space travel and space tourism, as algae can be used as both a fuel source and a food source, meaning that we would be able to grow our own food and fuel while on a space flight. Algae can be reproduced very quickly and only needs sunlight, or for heterotrophic algae, forms of energy like sugar. Algae are also useful to purify air and wastewater, as well as creating energy (Seydel, 2016). This experiment will be conducted to successfully gain information on how algae would be produced on something such as a space station or rocket. We will grow heterotrophic algae in the tube using sugar as a food source mixed with water. These chemicals will cause the tube to grow algae inside it and we will use a preservative chemical (Formalin) to preserve the algae and chart the results. Once we have both tubes, we will measure the amount of algae in the water of each tube, so as to see if regular growth methods of algae can be used in space.

9. Hillsborough County, Florida

Gravitational Force and Mushroom Growth

Grade 5
Lockhart Elementary Magnet School, Hillsborough County Public School District

Co-Principal Investigators: Angelina Jansen, Telvin Mexile
Collaborators: Dominic Battiato, Yasmin Bolen, Abdiel Diaz, Jimmy Jean, Amir Shabazz, Sir Jacob Thompson

Teacher Facilitator: Jane Kemp

Proposal Summary: The future of space flight will certainly include long trips through space to distant locations in the galaxy or beyond. Space travelers will need proper nutrition including essential vitamins and minerals that are found in fresh fruits and vegetables. Fruits and vegetables are, however, heavy and extremely perishable and not appropriate for space travel. We are in the process of growing organic oyster mushrooms because they are a variety of mushroom that are high in protein, minerals such as zinc and iron, and many vitamins such as B, D, and C. Our team proposes an experiment that will test mushroom growth in microgravity to determine if mushrooms could be grown and eaten on long trips beyond Earth. Certain types of mushrooms are high in critical vitamins and minerals that support high levels of energy and healthy immune systems in humans. They are also very light weight and, if we are correct, will grow on a very light base. They also grow very quickly and produce an abundance of spores giving them the ability to be a sustainable food source. We propose to test mushroom growth in microgravity to determine if mushrooms would be a viable long distance food source for future astronauts.

10. University System of Maryland

Inhibition of *P. Aeruginosa* Biofilm Formation with Silver Impregnated Antimicrobial Silicone in Microgravity

Grade 14
University of Maryland College Park, University System of Maryland

Co-Principal Investigators: Stacey Audrey Mannuel, Colton Justis Treadway

Teacher Facilitators: Daniel Serrano, Rachel Manthe

Proposal Summary: Here we propose a method to comparatively analyze the effect of antibacterial material on the growth of *P. aeruginosa* biofilm in micro-gravitational conditions. Biofilms are a large concern in the medical field due to its resistance to antibiotics and ability to cause infections. Additionally, they also pose a problem in the maintenance of space instruments and astronaut health. Our team proposes to test the new technology of silver-based antimicrobial silicone rubber by growing *P. aeruginosa* biofilms on both non-modified silicone and antimicrobial silicone in our FME. *P. aeruginosa* was chosen because it is a well-studied model for general biofilm formation. Previous research has demonstrated that the lack of physical stresses in microgravity promotes biofilm formation. Though silver-based antimicrobial silicone has been shown to reduce *P. aeruginosa* biofilm formation by 95% in normal ground conditions, we wish to see how it performs under low-shear conditions that are experienced in space in order to better understand its efficacy as medical implants. Furthermore, we hope that our data will reinforce the current research surrounding space biofilm formation and determine whether or not the ion mechanism of the silver-based antimicrobial silicone can successfully prevent biofilm growth. Upon return from the ISS, the biofilm grown on both the unmodified and antimicrobial silicone will be collected and compared to a ground control experiment via confocal microscopy analysis.

11. Fitchburg, Massachusetts

Effects of Microgravity on Alcanivorax borkumensis

Grade 10
Montachusett Regional Vocational Technical School, Montachusett Regional Vocational Technical School District

Co-Principal Investigators: Tanner O'Neal, Felipe Rodriguez

Teacher Facilitator: Paula deDiego

Proposal Summary: Does microgravity affect the ability of *Alcanivorax borkumensis* to degrade n-alkanes? On earth, *Alcanivorax borkumensis* thrives in oil contaminated water and feeds on phosphorous and nitrogen, organic compounds that can be found within crude oils. It is adapted to living in such oil contaminated environments and is used to accelerate the degradation of oil contaminated areas. Our experiment will test whether the bacterium is capable of degrading such oils in the unique conditions of microgravity, and if its process is accelerated by the low gravity conditions. The findings could help better our knowledge and understanding on how the bacterium functions and further the implications of using such a bacterium for marine rescue scenarios and oil spill cleanups, as well as oil based recycling materials within enclosed waste systems such as.

12. Galloway, New Jersey

Spores in Space: The Effects of Microgravity on Endomycorrhizae

Grade 14
Stockton University

Co-Principal Investigators: Danielle Ertz, Valkyrie Falciani

Teacher Facilitator: Dr. Tara Luke

Proposal Summary: The human race is moving closer and closer to long term space travel to explore beyond our blue planet and this has posed some interesting challenges. One of the main problems we face is growing our own long lasting food supply in microgravity. While a lot of work has been done to study plant growth in space, we believe that agriculture in microgravity can be improved by studying mycorrhizae: the mutualist relationship between plants and fungi. This relationship has been shown, on Earth, to greatly increase the productivity of agriculturally important plant species. We propose to study this by using the type 3 FME Mini Lab to combine *Glomus invermaium*, a species of arbuscular mycorrhizal fungus, and *Linum usitatissimum*, or flax, on the International Space Station (ISS), and then compare the results to a ground truth experiment. No matter the outcome of the experiment there is valuable information that we can gain that will aid space travel in the future.

13. Springfield, New Jersey

Which Type of Lettuce Seed Germinates Best in Microgravity

Grade 7

Florence M. Gaudineer Middle School, Springfield Public Schools

Co-Principal Investigators: Elisha Acosta, Maxwell Levy, Ian McLeer, Rudraksha Vyas

Teacher Facilitator: Alison Gillen

Proposal Summary: Our question is, which type of lettuce grows best with the effect of microgravity? We decided to test the effects of lettuce in microgravity because, many psychiatrists have recommended eating fresh foods to remind the astronauts of home. Another reason is that fresh foods are helpful to the health of astronauts on the ISS, and lettuce is the perfect medium. There are many types of lettuce seeds and we would like to experiment on 3 to 4 types of them. Our seed types we will be experimenting on are, Grand Rapids, Iceberg, Loose Leaf Blend and Black Seeded Simpson. Our experiment will help scientists learn about how fresh lettuce can be grown and eaten in space. It can help them do further research about how other fresh fruits and vegetables, and regular food that is not dried and packed in general, can be grown, eaten and used in microgravity. This information can be used to help us settle on Mars, but we have to start small. We tested the seeds with and without seed tape and there is no difference. We have one type of all the seeds just wrapped in paper towels, and we have the other group in our homemade seed tape. The type of FME we will be using is type 3. We will be using the type 3 FME because it will give equal space to water, seeds and a concentrated salt solution. The salt solution will be used to kill the plants after they germinate.

14. Waterford, New Jersey

Galaxy Eggplants

Grade 6
Waterford Elementary School, Waterford Township School District

Co-Principal Investigators: Ava Brennan, Marley Brennan, Hailey Reese
Co-Investigators: Abigail Baines, Angelina Mott

Teacher Facilitator: Debra A. Parker

Proposal Summary: Our experiment is to see how microgravity affects the germination of a eggplant seed. The normal germination time of the eggplant on Earth is seven to fourteen days (one or two weeks). We are also attempting to find the effects of the ozone layer of the atmosphere on plant growth. Our hypothesis is, without the ozone layer, the seed will sprout faster. We also believe that the germination will be impacted by microgravity. This experiment includes four materials: one eggplant seed, a piece of cotton 0.1x 0.1 cm^2, gibberellic acid, and distilled water. We will examine the effects of microgravity on the seed by measuring the size of sprout from space and the sprout on Earth.

15. Rochester, New York

The Effect of Microgravity on the Deterioration of Chlorophyll in Phytoplankton

Grades 11-12
East High School, Rochester City School District

Principal Investigator: De'Aunte Johnson
Investigator: Binti Mohamad
Collaborator: Tailor Davis

Teacher Facilitator: Mary Courtney

Proposal Summary: The experiment is designed to test how microgravity conditions affect phytoplankton chlorophyll deterioration rates. Phytoplankton are proposed to be used as the specimen to answer the question because microscopic marine plants are small enough to fit in an FME. Using an FME type I, samples will be in one volume, premixed. An abundant source of nutrients will make conditions as normal as possible. A spectrometer will be used to measure chlorophyll levels. The phytoplankton will not be allowed any sunlight or artificial light, only nutrients from a cocktail that is considered favorable for phytoplankton to survive. No astronaut interaction is necessary as this experiment is designed to measure the change in chlorophyll levels due to the microgravity environment. Initial chlorophyll levels will be measured prior to the sample being sent into space while a second sample is kept on earth under similar storage conditions. The hypothesis is that there will be a difference between the decay rates of chlorophyll in microgravity compared to gravity (earth) conditions.

16. Concord, North Carolina

Gravitropism of Radish Seeds in Microgravity

Grade 7
J.N. Fries Magnet Middle School, Cabarrus County Schools

Co-Principal Investigators: Sreenidhi Elayaperumal, Zayneb Shaikh, Paige Starnes

Teacher Facilitator: Paul Fields

Proposal Summary: The purpose of our experiment is to find the effects of varied gravitropism during germination of radish seeds. Gravitropism is a plant's response to the stimuli of gravity. The roots grow along with gravity, and the shoots grow against it. Gravitropism can affect the development of a seedling, contributing to aspects such the length and direction of growth of the shoot and roots. Space has a varying degree of gravity in contrast to the constant gravitational pull on earth, therefore, the seedlings grown in space may develop differently from ones grown on Earth. The direction of growth in the plant may be different, and the roots and shoot may have varying proportions. This experiment has importance, since learning about the development and growth of plants in space can one day have value, when more contributions are made to explore agriculture in space. If the gravity in space is not suitable for plant growth, we need to find a way to modify the plant or the environment in order to grow crops in space. In our experiment, we will be observing the germination of radish seeds in gravity and microgravity, to see if there is a difference between the two seedlings. We hypothesize that the seed in microgravity will have slower radicle and primary root development, but faster epicotyl and shoot development. The seedling from space may also grow in erratic directions. We hope to gain new knowledge from this experiment.

17. Knox County, Tennessee

The Removal of Blue-Green Algae Cells from Water in a Microgravity Environment

Grade 8
Vine Middle Magnet School, Knox County Schools

Co-Principal Investigators: Chandler Arnold, Sude Buyuktazeler, Shukurani Cimpaye, Jairo Tomas, Tayon Wright

Teacher Facilitators: Melody Hawkins, Dr, Rich McKinney

Proposal Summary: Blue-Green algae are a form of cyanobacteria, which are found in small bodies of water such as rivers lakes and ponds. Blue-Green algae contain toxins, which can be harmful toward people. Blue-green algae cause three different types of toxins, which are neurotoxins, hepatotoxins, and dermatoxins. Neurotoxins affect our nervous system, hepatotoxins affect our liver and how it functions, and dermatoxins irritate our skin. Some of these can even cause death (Oregon Department of Human Services: Public Health Division, 2010). Our topic will focus on the removal process of Blue-Green Algae using an alum and sodium aluminate mixture. This will help ensure the safety in microgravity environments and will make water safer for human consumption. We will test this by using a Type 2 FME to mix the alum and sodium aluminate with the blue-green algae water. Volume 1 will have 4.0 mL of alum and sodium aluminate mixture and volume 2 will have 5.2 mL of blue-green water. The data will be collected based on production of the floc. We hypothesize that the alum will block the phosphorus from feeding the bacteria, thus presenting the bacteria from growing. We anticipate that there may be some difficulties with the mixtures reacting in a microgravity environment due the lack of gravity.

18. Burleson, Texas

Concrete Compressive Strength

Grade 6
STEAM Middle School, Burleson Independent School District

Co-Principal Investigators: Danyel Archuleta, Mayleia Parker, Cole Rose, Christian Steele

Teacher Facilitator: Mindy Quisenberry

Proposal Summary: Our experiment is a force reading and analysis of concrete. We will make concrete in both space and on earth. When the concrete returns to earth, a microscope will be used, as well as a force gauge, to examine the differences between the sample formed in microgravity and the samplevformed on Earth. This experiment is also pertinent to future missions to colonize Mars – our neighboring planet. Concrete is a common construction material used on Earth to build houses and habitats. What, if any, are the effects of microgravity on the structural integrity of concrete? Although concrete gets warm it is a small enough sample so it will not affect any other experiments.

19. Lewisville, Texas

Effects of Microgravity on *Listeria innocua* Biofilm Formation

Grades 9-11
iSchool High STEM, Texas College Preparatory Academics

Principal Investigator: Andrew Zhao
Co-Investigators: Stephanie Do, Logan Worthington

Teacher Facilitator: Laurie Bailey

Proposal Summary: Listeria biofilms have a paramount effect on society, causing an estimated 1600 illnesses and 260 deaths annually in the United States alone (Scallan, et al). Biofilms are created when a colony of bacteria is exposed to an aqueous surface. This causes the bacteria to form natural polymers of high molecular weight and sugary molecular strands collectively known as EPS
(Extracellular Polymeric Substances) (Costerton, et al). In order to understand the effects of microgravity on *L. monocytogenes* biofilm, in connection to the food industry, the experiment will consist of having *L. innocua* cells exposed to two approved food contact surfaces to form a biofilm: polyethylene strips, and grade 302/304 stainless steel wires. The species of bacteria that will be tested in this experiment is *Listeria innocua*, a non-

pathogenic substitute for the more commonly known species of *Listeria monocytogenes* (Friedly, et al). The experiment will be conducted inside a Type 2 FME mini lab, with polyethylene strips, stainless steel wires, and trypticase soy broth in volume two and a colony of 10,000 *L. innocua* cells on a sterile bead in volume one. The results of the experiment will be compared to an identical ground experiment and analyzed with a confocal microscope to observe the density, three-dimensional structure, and thickness of the *L. innocua* biofilms. The knowledge gained from this experiment could reduce the number of food poisoning cases, bacterial infection cases on Earth, improve understanding of biofilm sanitization, and aid in the design of equipment and spacecraft (Mclean, et al).

20. Pharr, Texas

How does Microgravity Effect the Growth of an Allium cepa Seed?

Grade 11
Thomas Jefferson High School, Pharr-San Juan-Alamo ISD

Co-Principal Investigators: Kristina Evasco, Kirk Miller, Emiliano Nuno, Anna Pineda, Abigail Salazar

Teacher Facilitator: Andrew Martinez

Proposal Summary: We are conducting this experiment to determine how microgravity effects the growth of a Allium cepa seed. The experiment uses deionized water, cotton balls, and dry Allium cepa seeds. We will use a Type 3 FME. Volume 1 will have one cotton ball and ten dry Allium cepa seeds that will be placed in the cotton ball. Volume 2 will be filled with 1 mL of distilled water. Volume 3 will contain a selected fixative, Formalin, to stop the growth process. During the first week of the arrival of the space shuttle at the ISS, clamp A will be unclamped, releasing water to begin the germination process. In the week prior to undocking, clamp B will be unclamped to release the fixative and to preserve the experiment in microgravity. Upon return of the space shuttle, observations of the seeds will be done and data will be collected. Observations will include length of stem, observations of roots and stems, and stage of growth. If it is determined that microgravity allows for optimal seed growth, plants could be grown as a renewable food source in space. Plants could also help introduce new oxygen into the space vehicles. Studying gravitropism will also help to understand how to grow plants in space and find optimal growth. Food supplies and nutrients will be less of an issue. Future space travelers will be able to travel farther in the and live in space stations for longer periods of time if they travel with their own food.

21. San Antonio, Texas

Chytrid Frog Fungus Survival in Space

Grade 8
J.L. Matthey Middle School, Southside ISD

Co-Principal Investigators: Carlos Gonzalez, Neco Jimenez, Justin Kenkeof

Teacher Facilitator: Robert W. Bryson, Jr.

Proposal Summary: The chytrid frog fungus, *Batrachochytrium dendrobatidis*, is a fungus that is causing a global decline of amphibians and extinctions of some species. The fungus affects amphibians like frogs and salamanders and kills the host by infecting the layers of amphibian skin. It was discovered in 1999 but there is no cure. We believe the chytrid frog fungus will behave differently in microgravity. The life cycle of the chytrid frog fungus is complex and is composed of several different stages. Our hypothesis is that the stages of this life cycle cannot be completed in microgravity. Without feeling the force of gravity pushing down, the fungus will not know which direction to grow. If the frog fungus does not grow, then microgravity may be important to help scientists find a cure for the fungus.

22. Bullard, Texas – Mission 9 to ISS

Microgravity's Effects on Solanum tuberosum Resistance to Phytophthora infestans

Grade 9
Bullard High School, Bullard Independent School District

Co-Principal Investigators: Emma Rhyne, Valerie Vierkant
Co-Investigators: Emmalie Ellis, Raelee Walker

Teacher Facilitator: Alaina Cannon

Proposal Summary: *Phytophthora infestans* (Potato Blight) is a fungus-like protist that has caused many crop failures throughout the world, including the historical Great Potato Famine in Ireland . This protist invades the leaves and spreads to the tubers, killing the plant within days. Unless quickly disposed of, the infected plant will spread the disease throughout an entire field. Potato Blight cannot be killed, but varieties of potatoes have been discovered that are naturally resistant to the protist. The primary goal of this experiment is to determine how microgravity affects *Solanum tuberosum* resistance to *Phytopthora infestans*. Considering the potential need for future crops in space, it is important to expand our knowledge on microgravity farming. Little is known about the effect of microgravity on *Solanum tuberosum*,and even less is known about blight-resistant varieties. In this experiment, a sample of a blight-resistant *Solanum tuberosum* will be exposed to *P. infestans* aboard the International Space Station (ISS) and compared to our control, which will be conducted on Earth in normal gravity. Previous experiments have shown that members of the family *Phytopthora* demonstrate increased virulence in microgravity. The secondary goal of this experiment is to investigate how naturally blight-resistant varieties of *S. tuberosum* protect themselves from infection. This experiment will provide further insight to the poorly understood resistance mechanisms of certain varieties of *S. tuberosum*. We believe this experiment's results will show the blight-resistant potato is more susceptible to *P. infestans* in microgravity as compared to normal gravity conditions.