SSEP Mission 9 to ISS Selected Flight Experiments
Communities, Teams, and Abstracts

SSEP *Endeavor* Experiments Payload
Launching on SpaceX-10, Cape Canaveral Air Force Station, Florida

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

1. Calgary, Alberta, Canada

Shells of Glass Capsules, Covered with Different Substances Reacting in Regular Water

Grade 9
Langevin Science School, Calgary Board of Education

Co-Principal Investigators: Metro Anderon, Safo Arthur, Arnav Jain, Tatum Parker

Teacher Facilitator: Shane Turner

Proposal Summary: The main aim of our project is to observe how three different capsule shells, covered in corn starch (Carbohydrates), gum Arabic (Gum) and sucrose (Carbohydrates) dissolve in regular water, in addition to the reaction and release rate in a microgravity environment. Our background research has stated that these substances will dissolve in water, but some may just settle at the bottom if let to sit for a certain amount of time. Certain coatings may react “faster” and ”slower” from lack of gravity but apart from that, we predict that starch will not be completely dissolved; gum Arabic will dissolve at all and sucrose will dissolve. The project will also consist of an acrylate, sodium polyacrylate. Sodium polyacrylate will stop the test sodium polyacrylate will absorb many times its size and form a polymeric gel. We are halting the dissolving process as we need to examine the results of the reaction of only sixty seconds. After the test is completed aboard the ISS, we will observe which substances can be completely dissolved, which can’t be dissolved at all or which were approaching their dissolving point. Once we have acquired this knowledge, future astronauts can be sent encapsulated medication with a certain substance covering the outer shell for more effective treatment. Knowing the differences may improve how a medication is produced and delivered into space. Medicine can also be improved on Earth by prolonging realise rate, and will make pills not needed as often.

2. Vancouver, British Columbia, CANADA

Red Worm Composting in Microgravity

Grades 6-7
Westcot Elementary School, West Vancouver School District 45

Co-Principal Investigators: Griffin Edward, Vesal Farahi, Shania Farbehi, Kristopher Kirkwood, Joseph Piovesan

Advisors: Rick Adam, Dr. Leigh Palmer

Teacher Facilitator: Matt Trask

Proposal Summary: Our group proposes to send red worms into space with the aim of gaining important scientific knowledge that could lead to benefits for future space travel. On August 10, 2015, astronauts aboard the ISS harvested and ate romaine lettuce they planted in July. Red worms eat plants scraps and then excrete nutrients helping newer plants grow. This is called composting. As Patrick Cartwright said, there are many factors associated with composting: “Worms, however, are the real heroes of composting.” If we send our project into space, we will determine how red worms grow and function in microgravity. Astronauts lose their bone and muscle mass while in microgravity. Red worms have no bones but they do use muscles to burrow through dirt. We want to know whether or not red worms would be able to burrow in microgravity. Red worms are also a very important part of composting toilets. Composting toilets separates feces from other waste into a giant metal canister. Inside the canister, red worms then turn the waste into fertile soil that could be used to grow food. If red worms can grow in space, we could potentially have a fully functioning space garden with soil composted by the worms from the fecal waste produced by astronauts. Red worms in space would save the cost of transporting food into space because astronauts could grow their own food. As well, red worms could eliminate the cost of the waste capsules that are currently being used to dispose of human waste.

3. Santa Monica, California

The Effect of Microgravity on Preservation of Space Using Lemon Juice

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

Co-Principal Investigators: Gina Kim, Thatcher Lee, Roxy Ong, Sydney Sobel
Collaborator: Anthony Bvlgari

Teacher Facilitators: Gretchen Gies-McLaughlin, Carol Wrabel

Proposal Summary: Considering the numerous restrictions, food storage has often been a predicament for space travel. The purpose of this experiment is to provide insight into more nutritious yet effective methods of food preservation. For this experiment, we will preserve a 7.5 cm x 0.8 cm x 0.8 cm block of “Classic Spam” with 4. mL of Lisbon lemon juice (citric acid). The question to be addressed is whether the preservation of spam in microgravity with citric acid, as measured by bacterial growth, differs compared to Earth. While the experiment is conducted aboard the International Space Station, the control experiment will be carried out on Earth. Once the FME returns from orbit, both samples will be compared to evaluate our hypothesis that in microgravity the growth of bacterial colonies will decrease (NASA). The goal of this experiment is to contribute ideas for food storage aboard the International Space Station.

4. East Lyme, Connecticut

Will a Biofilm Form on a Rat Catheter in Microgravity Differently than in Gravity?

Grade 6
East Lyme Middle School, East Lyme School District

Co-Principal Investigators: Ritisha Ande, Madeline Fraser, Ethan Moore, Ethan Novick

Teacher Facilitator: Deborah Galasso

Proposal Summary: The purpose of this experiment is to see if a biofilm will form differently on a rat artery catheter in microgravity from the bacteria *Staphylococcus epidermidis*, which is naturally occurring in the human body. If the biofilm forms thinner in space than on Earth, this will provide added information to NASA for astronaut health and information for scientists and doctors to hopefully improve catheters and reduce infection on earth. We already know that *Staphylococcus epidermidis* is a bacterium that is already in the human body for all people. When someone has a catheter in their body, a *Staphylococcus epidermidis* biofilm can form on it causing this skin infection. The skin disease is an acne-like rash that is red and inflamed. If a person has surgery, he or she is more likely to get a biofilm on their catheter. This happens because *Staphylococcus epidermidis* likes to stick to any type of plastic. After it sticks it can create a biofilm that clogs the catheter or the implant. This leads to failure and infection (Cuong and Otto 1). We would like our experiment to be running for 2 days on the space station in order for the bacteria to multiply sufficiently. We chose this experiment because many people have died from having this condition known as a Staph infection. This experiment can help because if an astronaut gets sick on the ISS and needs a catheter inserted, we will know better the risks that are involved with this procedure.

5. Hillsborough County, Florida

Germination of Quinoa in Space

Grade 5
Mabry Elementary School, Hillsborough County School District

Co-Principal Investigators: Jessie Babb, Serena Bassart, Mya Metheny, Julianna Tran

Teacher Facilitator: Jessica Strauss

Proposal Summary: Our group proposes to investigate how microgravity affects the germination of quinoa seeds. We are planning to count the seeds germinating on Earth compared to the seeds that germinate in microgravity with the same investigation. First we will set up the test tube with one clamp separating the murshinge (gel to hold seeds) and the seeds. We would tell the astronauts on board to unclip the clamp and then shake the tube gently (shake from side to side) until the seeds are stuck within the gel. We will count the number of seeds and how they formed in both microgravity and Earth.

6. Boise, Idaho

Living Water Filters: Triops in Microgravity

Grade 5
North Star Charter School, North Star Charter School District

Co-Principal Investigators: Alexandra Garvin, Bailey Corrigan, Bostyn Corrigan, Raigan Teeter
Co-Investigators: Madeline Clark, Azzio Simontacchi

Teacher Facilitator: Patrice Rex

Proposal Summary: Scientists have wanted to send people to other planets for a long time. We'll need pipes and plumbing, but what will clean the waste-water produced by people living in space? Triops could possibly be used in microgravity because they eat organisms like bacteria, algae, mosquito larvae and water fleas that can make the water unsafe for drinking. Triops are small crustaceans that have been on Earth since prehistoric times. They are filter feeders that can remove harmful organisms from water sources. Our experiment will test if test if triops can filter bacteria out of pond water in microgravity as well as they do on

Earth. After the experiment is returned to us, we will work the Boise Waste Water Treatment facility to analyze the water to see which kinds of bacteria remain in the water, using a Heterotrophic Plate Count method. We will also measure the mass of the triops that were hatched in microgravity and compare it to the mass of the triops that were hatched on Earth. Water is essential to life; it must be clean for drinking. If it is not clean, it can do harm to the person or animal consuming the water. If triops could function properly in space, astronauts could release triops into the water source to clean it.

7. Potomac, Maryland

Shewanella oneidensis and Iron Ions in Microgravity

Grade 10
Bullis School

Co-Principal Investigators: Skylar Jordan, Amanda Kay
Advisor: Dr. John Ondov

Teacher Facilitator: Daniel TerBush

Proposal Summary: We expect that the process by which *Shewanella oneidensis* removes metal ions from water will not differ in microgravity compared to normal gravity. Water is a necessity for human life and everyday, many metals are found in important water sources. Many people do not realize how the water they are consuming are contaminated with heavy metals. Excess amounts of heavy metals can destroy vital human organs such as the brain and liver. This experiment tests how *Shewanella oneidensis* can remove heavy metals from contaminated water which will help future water contamination issues if the results come back as expected. First, data will be collected based on the amount of iron ions present in the water before coming in contact with *Shewanella oneidensis*. This will be collected before sent to the International Space Station (ISS). Data will also be gathered for the amount of iron ions in the water after coming in contact with the bacteria. This data will be collected after the experiment comes back from the ISS. Since the hypothesis states that gravity will not effect the removal process, the amount of iron ions present in the microgravity experiment are expected to be the same as the amount present in the ground experiment. When both experiments are back in the lab, we will compare the amount of iron ions in the solutions to tell if *Shewanella oneidensis* removed iron ions differently in the two different environments and whether or not gravity affects the removal process of iron ions.

8. Fitchburg, Massachusetts

Streptococcus mutans Production of Lactic Acid in Microgravity

Grades 10-11
Montachusett Regional Vocational Technical High School, Montachusett Regional Vocational Technical School District

Co-Principal Investigators: Olivia Houle, Shelby Landress
Collaborators: Madison Clark, Zachary Houle

Teacher Facilitator: Paula deDeigo

Proposal Summary: This experiment has the potential to be successful in finding a more efficient dental care regimen for astronauts. The factor to be observed in the experiment is whether or not *Streptococcus mutans* produce more lactic acid in microgravity and if the reproduction rate of the previously stated bacteria is affected in space. Improper oral hygiene is a factor that contributes to poor health in the rest of the body. If the

Streptococcus mutans prove to be a greater force in space than they do on Earth, then the aseptic habits of astronauts may need to be modified. Previous studies referenced in this proposal reinforce the hypothesis that dental caries are more likely to occur in space because of how microgravity influences *S. mutans*.

9. Traverse City, Michigan

Growth of Blue-Green Algae in Space

Grade 10
Traverse City West Senior High School, Traverse City West High School

Co-Principal Investigators: Sam Church, Ryan Hayes, Hayden Holmes, Robert Lohr

Teacher Facilitator: Patrick Gillespie

Proposal Summary: We are testing the growth of Blue-Green algae to see if the growth changes when it is put in space, We want test this because the blue-green algae produces hydrogen and oxygen, so that later in the future when we're in space we can use the oxygen to breathe and the hydrogen as fuel. We will be putting the algae in the capsule with water, a rock, and plant fertilizer for nutrients. We will have the same rocks, amount of water, and amount of algae here on earth.

10. Jersey City, New Jersey

The Effects of Microgravity on Muscle Tissue Regeneration

Grade 12
McNair Academic High School, Jersey City Public Schools
Co-Principal Investigators: Joshua Monserate, Jay Pandya, Nirav Patel, Sardar Hamza Zakria

Teacher Facilitator: Maria Emma Osoria

Proposal Summary: The aim of the experiment is to analyze the potential of the drug, Tissue Regeneration Factor at 150 mg (TRF-150) to regenerate shoulder muscle tissue of an adolescent pig faster when exposed to a microgravity environment. Therefore, the analysis aforementioned will determine the amount of tissue regenerated under controlled scenarios of induced harm. Both qualitative and quantitative methods of measurement will be used to determine this experiment's success. Quantitative measurements include density of the remaining tissue and amount of oxygen and glucose consumed. Qualitative analysis will include placing the tissue under a scanning electron microscope to visually determine how much of the tissue has regenerated and the pattern of the issue regenerated. This experiment will be conducted in a Fluids Mixing Enclosure (FME) Mini-lab type 3 with a solution of formaldehyde and TRF-150 at the edges of the tube, in the middle of the tube will be the tissue in question with a controlled incision made on it and a solution of glucose, proteins, oxygen and testosterone. This experiment will help determine if a microgravity environment aids in the regeneration of organic tissue. If the experiment implies the increase of the regenerative properties of TRF-150 then simulated microgravity environment can be implemented to help patients enduring a muscle injury.

11. Springfield, New Jersey

The Effects of Microgravity on Grass Seeds' Growth

Grade 7
Florence M. Gaudineer Middle School, Springfield Public Schools

Co-Principal Investigators: David Ares III, Jeremy Dash, Daniel Munoz
Co-Investigators: Timothy Burns, Antonio Nacci

Teacher Facilitator: Paul Schonfeld

Proposal Summary: We are interested in seeing if microgravity affects the growth rate of plant seeds. In our experiment we want to test the effects of microgravity on the growth of Rye grass seeds. Our group is also testing to see if Rye grass seeds are able to grow without gravity and light. We have found conflicting information during our research. We have been taught in school, through books that gravity affects the way seeds are grown. The roots grow in the direction of gravity. However, in the articles we read online, it was written that gravity had little affect on the way seeds were grown. We think the benefit of trying to grow seeds in microgravity is: if people needed to stay in space for long periods of time, they need to know the total effects of microgravity on plant growth. We think that the seeds will grow in microgravity and their growth will increase more than on Earth. For our experiment to start the seeds' growth, we will only give our seeds water. In our three-chambered tube we will put water in volume 1, Rye grass seeds in cotton to keep them in place in volume 2, and in volume 3, we will have salt for our fixative. Because of the tests we have done we know that on average a Rye grass seed take 5-12 days to grow. And we have been able to stop the growth using a salt solution.

12. Buffalo-Niagara, New York

Tuber Transport and Subsequent Terrestrial Growth

Grades 7-8
Hamlin Park Claude and Ouida Clapp School #74, Buffalo Public Schools

Principal Investigator: Gabriella Melendez
Co-Investigators: Toriana Cornwell, Shaniylah Welch
Advisors: Dr. James Berry, Dr. Mary Bisson

Teacher Facilitator: Andrew Franz

Proposal Summary: This project is about the germination of Yukon gold potatoes because of the distinct lack of grocery stores in outer space. Plants on earth develop under the influence of gravity. Plants must support themselves against the force due to gravity. On the International Space Station, a vehicle that is in constant free fall, gravity does not hold the same effect (microgravity). We believe that germination in small containers is necessary to eventual planetary terraforming (you can start the growth process before landing on another planet). We wish to try to grow potatoes on the International Space Station so we can see if the plants will be able to grow on other planets, or travel there.

13. Eugene, Oregon

SLIPS in Microgravity

Grade 8
Arts and Technology Academy, Eugene School District 4J

Co-Principal Investigators: Ray Newell, Garrett Price, Kobe Skidmore

Teacher Facilitator: Kathleen Taylor

Proposal Summary: Does Slippery Liquid-Infused Porous Surfaces (SLIPS) decrease the scale of an omniphobic surface in microgravity? An Omniphobic Surface scale is a measurement of how slippery something is. SLIPS is the world's slipperiest substance, it has been out for half a year, and is based off the functionality of the pitcher plant. After it rains pitcher plants keep raindrops as a film on the edge of their mouth so that when ants walk on the rim, they slip into their stomach. SLIPS only does one thing, it makes a surface of a solid slippery so that no liquid can touch the face of the solid that's coated. We are testing SLIPS in a microgravity environment to find out if it has the same properties as it does on Earth. If it does it could possibly solve frostover for rockets at launch and in microgravity. We will be using a type 3 FME. Inside volume 1 we will have a cotton ball. Inside Volume 2, there is an aluminum strip 12.5mm x 35mm coated with SLIPS on one side. In volume 3 there will be 1.5ml of corn syrup. The tube will be coated on the inside with SLIPS in both volume 2 and 3. In this experiment we are hoping to solve frostover on the ISS with SLIPS by finding if SLIPS can not only stay on the face of a solid but still make liquids slip off of the solid.

14. Columbia, South Carolina

The Effects of Microgravity on the Turbidity of Non-Newtonian Fluid Mixture of Cornstarch and Water

Grade 9
W.J Keenan High School, Richland School District One

Co-Principal Investigators: Cedric McQueen, Ryan Mathews, Tevin Glover

Teacher Facilitator: Kirstin Bullington

Proposal Summary: My group's research question is, "How does microgravity effect the turbidity of a Non-Newtonian mixture, cornstarch and water?" Turbidity is the measure is the measure of light that can pass through a water sample. When the turbidity of a mixture is higher, the temperature is higher due to absorbed heat. Cornstarch is obtained from the endosperm of the corn kennel. In regular gravity, this non-Newtonian fluid is hard when you hit it hard or fast, but when you operate in a slow motion it acts like a liquid. When left to settle, the mixture separates somewhat due to gravity, so we were curious if microgravity would affect the initial mixing and then its settling. We plan to use a Type II FME, in which cornstarch should take up 6.9ml of the tube, and distilled water should take up 2.3ml. The interactions requested are to first unclamp the FME and shake vigorously to create the mixture. Before leaving the ISS, we request that the FME be reclamped in its original place. That way, despite agitation during re-entry and shipment, we can compare the turbidity of the two samples to determine how well the sample mixed and stayed mixed in microgravity. The same setup will be used in regular gravity for comparison to determine what effect, if any, microgravity had on the non-Newtonian fluid mixture. Turbidity will be measured through a myDaQ turbidity sensor and by spectrophotometer.

15. North Charleston, South Carolina

How doe Spaceflight Affect the Detachment of Zinc Whiskers?

Grade 11
Palmetto Scholars Academy, South Carolina Public Charter School District

Co-Principal Investigators: Kayla Capitan, Gabriel Voigt

Teacher Facilitator: Kellye Voigt

Proposal Summary: How does spaceflight affect the detachment of zinc whiskers? Metal whiskers cause large-scale damage to electronics by interfering circuits and electronic interfaces. These tiny threedimensional crystalline structures cause great damage, although most whisker-induced failures are left unreported due to lack of understanding and proper analysis methods. Although zinc was used to mitigate tin-whisker failure modes, zinc has displayed full capability of disrupting electric circuits and creating undesired connections between these circuits, resulting in shorts. The scientific community has limited knowledge and understanding of the behavior of metal whiskers, especially of detachment and of zinc whiskers, putting this experiment at the culmination of whisker behavior and whisker failure mode comprehension.

16. Knox County, Tennessee

Testing the Effectiveness of Tobramycin and Dexamethasone Ophthalmic (Tobradex) on Staphylococcus Aureus Type of Bacterial Conjunctivitis in Microgravity

Grades 7-8
Bearden Middle School, Knox County Schools

Co-Principal Investigators: Moamen Emara, Alex Hoffman, Elise Kersch, Jack Lathrop, James Pierce, Mauricio Sanchez, Riley Speas, Katherine Trent, William Walker

Teacher Facilitator: Kayla Canario, Virginia Brown

Proposal Summary: Bacterial conjunctivitis is a common infection and can affect astronauts during space travel. As space travel progresses, bacterial conjunctivitis could become a problem. We hope to address this problem by finding out if bacterial conjunctivitis will be affected by a normal antibiotic treatment. By doing this experiment, we hope to better understand the growth and treatment of bacterial conjunctivitis. Understanding the growth and treatment will not only allow us to effectively treat future infections, but will have implications of treating other bacterial infections in space as well.

17. Bullard, Texas

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.

18. Burleson, Texas

Kidney Stone Conumdrum

Grade 5
The Academy at Nola Dunn, Burleson Independent School District

Co-Principal Investigators: Hannah Greenhill, Caleb Quisenberry, Cooper Williams

Teacher Facilitator: Riki Bunch-Pettigrew

Proposal Summary: We propose to answer the question: Does microgravity have an effect on the disintegration of kidney stones (nephrolithiasis) in chanca piedra (phyllanthus niruri)? This information will let us know if chanca piedra will help astronauts with their frequent kidney stone issue. If they do not dissolve in microgravity, we will have to find an alternative solution. On Earth kidney stones are painful and stress causing, but with the frequent number in space they waste important time they could be using to do their jobs. They spend nine hours of their day researching and working on their projects, eight hours sleeping, and about an hour to have a meal because they have to heat the food, catch it, then eat it. Also, exercising two hours a day helps astronauts prevent bone and muscle loss. In our test we will simulate chanca piedra dissolving kidney stones in the human body. We want to prevent kidney stones for astronauts. We will put two kidney stones in volume one, volume two will have chanca piedra, and volume three will be filled with formalin. We will test this on Earth and in space then compare how much they dissolved. The result of this experiment might reduce the amount of time the astronauts deal with kidney stones. It will let us know if the astronauts will still have to go through all the pain as well. If they did not pass kidney stones so often they could be solving problems to help them live in space.

19. Houston, Texas

pGLO Plasmid Transfer in Escherichia coli as a Means to Track Antibiotic Resistance in Microgravity

Grade 11
Cesar E. Chavez High School, Houston Independent School District

Co-Principal Investigators: Esmeralda Cervantes, Ashley Olvera
Co-Investigators: Omar Compos, Esmeralda Pantoja

Teacher Facilitator: Dr. Jason Busby

Proposal Summary: It has been proven that bacteria grow and interact much differently in space. In the past, NASA sent disease causing bacteria into space to observe its growth. However, studies are very limited in the area of bacteria transferring genes or plasmids for antibiotic resistance in a microgravity environment. The purpose of this study is to explore this area via the transfer of the pGLO plasmid carrying a gene for ampicillin resistance among colonies of *Escherichia coli*. Bacterial growth and antibiotic resistance transfer will be measured in an FME Type 1 modified into a common bacterial slant. Growth will be observed and measured on a periodic basis while the sample remains in orbit. The pGLO plasmid is being used due to its nature of glowing under a UV light source making observation of transfer easily observable with a small handheld UV light and the human eye. Possible implications for this experiment could lead to modification of treatment for astronauts on missions; and possibly before missions to condition the immune system, based on how the bacteria interact in a microgravity environment.

20. McAllen, Texas

The Effects of Perchlorate on Plant Germination in Simulated Martian Conditions in Microgravity

Grade 11
IB at Lamar Academy, McAllen Independent School District

Co-Principal Investigators: Sabrina Benitez, Sofia Escobar, Juan Pablo Flanagan
Advisors: Marc Braden, Dr. Anxiu Kuang, Dr. Michael Wayne Persans

Teacher Facilitator: Laura Nikstad

Proposal Summary: One of NASA’s many current projects, and one the general public has been waiting for ever since we set foot on the Moon, is the human mission to Mars. The recent discovery of liquid water on Mars has increased our anticipation of this dream; however, along with water, it has been found that Martian soil contains high levels of magnesium perchlorate—a contaminant toxic to humans. Analyzing the results of the experiment will provide insight into the effects of perchlorate, combined with microgravity, and how these unfamiliar conditions will affect the possibilities of ever establishing a sustainable colony on Mars. Future manned missions to Mars are in the works and questions about nutrition and sustainability must be answered. This experiment will give us a greater understanding of food growth on Mars, a planet with a significantly smaller amount of gravity than Earth. On the ISS, our Type 3 FME mini-lab will contain Martian simulated soil with tomato seeds and distilled water to catalyze the germination. After twelve days, a solution of 10% Neutral Buffered Formalin will be added to the soil in order to halt the growth and “freeze” any viable data so that we may be able to observe the tomato sprout on Earth and compare the results to the control groups in order to find how plants that have evolved to fit Earth’s conditions will grow and survive in conditions very different from our own.

21. Bellevue, Washington

Arabidopsis thaliana germination in Martian soil simulant

Grade 7
Open Window School, Northwest Association of Independent Schools

Co-Principal Investigators: Subi Lumala, Vivienne Rutherford, Catherine Whitmer

Teacher Facilitator: Brian Preston

Proposal Summary: *Arabidopsis thaliana* are plants that are highly experimented on. Our experiment is an investigation to see how they will grow in microgravity, and in a soil similar to that of the surface of Mars. *Arabidopsis thaliana* would be useful to have on Mars because of its experimental potential. It is not possible on Earth to simulate the lower gravity of Mars, so microgravity provides a test of lower-than-Earth gravity. The gravity on the ISS is almost 0 m/s^2, the gravity on Mars is 3.8 m/s^2 (Universe Today), and the gravity on Earth is 9.8 m/s^2 (Universe Today). Gravity on the ISS allows us to test plant growth in an environment closer to the gravity on Mars.

SpaceX CRS-10 Re-flight of SSEP Mission 7 Experiment due to on orbit operation anomaly.

The following experiment was 1 of 24 SSEP Mission 7 experiments. This is experiment is being re-flown due to an on orbit operation anomaly during its initial flight.

22. Santa Monica, California

The Effect of Microgravity on Paper Chromatography

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

Co-Principal Investigators: Samuel Buckley-Bonanno, Adam Chamas, Charlie Gooding, Shrayes Raman

Teacher Facilitators: Carol Wrabel, Susan Stivers

Proposal Summary: The investigation proposes to determine whether chromatography can be performed in microgravity, and to discover how it may differ from being performed on Earth. Chromatography is a method by which you separate substances, using the capillary action of a solvent through a permeable medium. Paper chromatography was chosen because of it's simplicity, and ease of use. For the experiment 3 ml of distilled water, 10 cm of coffee filter paper, and Papermate PMOP felt tipped pen ink will be used. A Type 3 MixStik was chosen, as it has the necessary capabilities in which the relatively complex experiment can be done. In Volume 1 there will be 3 ml of Water. In Volume 2, 10 cm of coffee filter paper, and in Volume 3, the ink dot and the rest (9 cm) of the coffee filter paper. When the experiment returns to Earth, how far, and in what ways the ink and water have traveled through the paper will be measured. This data will be compared with the controlled experiment on Earth. The knowledge gained from this analysis will provide a better understanding of chromatography, and various other aspects of physical chemistry, like capillary action. In the long run, this information can aid in the design of chromatography setups, whether on Earth or in microgravity. Additionally, any enclosure that permits capillary action, or molecular actions of a solute, can be designed in a better way, using the knowledge gained.