SSEP Mission 5 to ISS Selected Flight Experiments Communities, Teams, and Abstracts

SSEP *Charlie Brown* Experiments Payload Launching on Orb-2, MARS, Wallops Island, VA

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

1. Teachers in Space (TiS) Inc. Community, Space Frontier Foundation

Jump to the TiS Program's Community Profile: http://goo.gl/Tijr5Q

Affected Efficacy of Sprayed Enamel Coating as a Corrosion Inhibitor

Grade 7-8
Milton L. Olive Middle School, Wyandanch Union Free School District, New York

Co-Principal Investigators: Alayna Appolon and Zaire McQueen

Co-Investigators: Vanessa Argueta, Maria Blanco, Geneve Carbajal, Fabio Compere, Harpaven Dhariwal, Britney Huauya-Flores, Marcine Jeannot, Brenda Lagos, Jose Lopez, Ariela Martinez, Kimberly Martinez, Macy McCalla, Utomi Nwaesei, Lilia Parrilla, Henry Pereira, Princess Pereira, Brandy Salguero, Samantha Sills, Jessica Urias, Evelyn Vanegas, Mirna Ventura Molina, Richard Wilson, and Anthony Yumpo

Teacher Facilitator: David B. Milch, Technology Teacher

Proposal Summary:
Our team's focus is on the effectiveness of Rust-Oleum's 'Stops Rust' spray paint. We will evaluate the resilience of the coating on Earth to its resilience in a microgravity environment. Due to familiarity, Coca-Cola will be used as the corrosive agent (also, multiple bottles from the same lot may be easily acquired). We will affix two iron disks (99.5% pure Fe) uniformly sprayed with the protective coating, as well as two disks without a coating, onto an acrylic strip using silicone caulking underneath. A 72-hour exposure to the soda will occur on the ISS and on Earth, stopped via a polymer absorbing the Coca-Cola. The remaining average coating thickness will be measured to within 0.1µm as well as visually inspecting the surfaces assisted by a microscope.

2. Flagstaff, Arizona

Jump to Flagstaff's Community Profile: http://goo.gl/0Ux7kM

How does an onion root cell divide in microgravity?

Grade 7
Northland Preparatory Academy

Co-Principal Investigators: Asa Avelar, Dylan Wachowski, and Ethan Willis

Teacher Facilitator: Susan Brown, Science Teacher

Proposal Summary:
We want to know if onion root cells will be able to replicate DNA in the absence of gravity. We will germinate an onion seed on board the International Space Station (ISS) and on Earth. We will analyze the cells of the root of each sample to determine if there are any mutations during DNA replication. We predict that the cells, during the process of cell division, will have trouble replicating in a microgravity environment. If we learn that mutations are commonplace in space, then the ramifications are great for all organisms including astronauts.

3. Santa Rosa, California

Jump to Santa Rosa's Community Profile: http://goo.gl/lJ1Qk9

Triops as a Protein Source

Grade 7-8
Mark West Charter School, Mark West Union School District

Grade 5-6, Riebli Elementary School, Mark West Union School District

Co-Principal Investigators: Maya Favela, Hannah Froman, Dylan Kattengill, Robert Langer, Layla Morris, and Cassidy Walton

Co-Investigators: Joe Brown, Anthony Campos, Aidan Gomon, Lauren Des-Bordes, Emily Johnson, Jesus Mendoza-Bernabe, Fern Rodriguez, and Nellie Sedeno

Teacher Facilitators: Corissa Sunde, Mark West Charter, Science Teacher; Andrea Farrell and Stacey Fong, Riebli Elementary, Elementary Teachers

Proposal Summary:
The focus of this project is to study the feasibility of *Triops longicaudatus* as a protein source to help sustain life in space with microgravity conditions. In addition to plant-based diets, producing a food source that is rich in protein and can fit in the confines of a space station will be necessary. We propose to study whether *Triops longicaudatus* hatch and grow well in microgravity as a possible protein source for long term flight conditions.

4. Washington, DC – Cesar Chavez Charter School Cluster

Jump to Washington DC's Community Profile: http://goo.gl/LcSaUJ

Growth of Radish Plant in Microgravity

Grade 9
Chavez Prep, Cesar Chavez Public Charter School for Public Policy

Co-Principal Investigators: Megan Ramos, Lizeth Urioso, and Michelle Vanegas-Lacan

Teacher Facilitator: Ms. Swain, Earth Science Teacher

Proposal Summary:
The purpose of this experiment is to see if microgravity has an effect on the way that radish seeds grow. The roots and shoots of plants usually need gravity to be able to grow in a specific direction. Roots grow towards gravity, usually in the direction towards the center of the Earth, and the shoots grow away from gravity towards the sky. The reason this experiment is being done is because the roots and shoots of a plant might grow in different directions in microgravity on the ISS than they grow on Earth, which could affect how the plant creates food and develops. It was predicted that the roots will grow in many different directions instead of one direction like they do on Earth because there is less gravity. To test this experiment a Type 3 FME tube will contain water in Volume 1, a sponge and two radish seeds in Volume 2, and 91% isopropyl alcohol in Volume 3. In addition to the experiment done in space, another experiment with the same materials is going to be done on Earth. When the experiment in space comes back to Earth, the plant that was kept here on Earth will be compared to the plant that was sent to space. The information will help see how microgravity affects a plant's growth. If the results are similar then that means that microgravity does not have a big impact on a plant's growth.

5. Hillsborough County, Florida

Jump to Hillsborough County's Community Profile: http://goo.gl/JyaEm6

How many seeds will germinate in microgravity vs. on Earth?

Grade 5
FishHawk Creek Elementary, Hillsborough County Public Schools

Co-Principal Investigators: Miranda Corbo, Srinidhi Raghavan, and Isabelle Utsler

Teacher Facilitator: Mary Vaughn, Teacher

Proposal Summary:
We propose to answer the question: How many seeds will germinate in microgravity vs. on Earth? Our team is looking for the frequency of seed germination in space. The purpose of this investigation is to see if lettuce will successfully grow in space providing a nutritious vegetable for our future astronauts. Since lettuce grows very quickly, with the right conditions, we feel this would be a good source of nutrition for the astronauts.

It is important to study how seeds grow in space as it will help the astronauts in many ways. This will decrease the amount of food the astronauts will need to bring on a mission therefore decreasing fuel costs. When astronauts go for longer missions sending up food is not an option as it will require too much additional mass on the rocket. If astronauts are able to grow their own food there would be a fresh food source keeping our astronauts healthy when they travel for longer missions. Also, if a mission is delayed astronauts will not have to worry about running out of food.

6. Jefferson County, Kentucky

Jump to Jefferson County's Community Profile: http://goo.gl/jmEedk

Will microgravity conditions increase the rate of yeast fermentation in honey?

Grade 9-12
The Academy @ Shawnee, Jefferson County Public Schools

Co-Principal Investigators: Jacob Boeschel, Ted Loeser, Lance Winemiller, and Deandre Curry

Co-Investigators: Elizabeth Bates, Joseph Jewell, Jacob Boeschel, Peyton Adelmann, James Vance, Sean Moore, Brittany Jarboe, Miranda Strane-Harris, and Anthony Watson

Teacher Facilitator: Imogen Herrick, Science Teacher

Proposal Summary:
We are testing the effects of microgravity on the production of alcohol by yeast in a viscous honey/water medium. Yeast is a single-celled organism. When yeast consumes simple sugars such as glucose, the byproducts are carbon dioxide and ethanol. Yeast can't live on sugar alone. It is most active in an environment with other nutrients. Honey has many of these nutrients but is more resistant to being fermented. A pure honey solution will ferment, but on Earth it can take three months to a year. We believe that when introduced in an environment with microgravity the fermentation of yeast will speed up because the molecules will be in a state of constant free fall therefore increasing the rate of reaction. We will measure the specific gravity of our samples and use the BRIX scale to determine remaining sugar concentration. Both samples will be further analyzed by using a pH meter to determine acidity of each sample. Comparing acidity will also provide evidence for which solution produced more alcohol. On Earth, yeast fermentation is used to make a variety of drinking alcohols. However, alcohol can be utilized in many other forms such as antiseptics or in the production of several foods. Antiseptics are vital to the medical industry for the removal of bacteria. If this data shows a higher yield of alcohol in microgravity, the space station could have a sustainable source of many vital essentials, and there would be a higher understanding of how micro-organisms react in microgravity.

7. Howard County, Maryland

Jump to Howard County's Community Profile: http://goo.gl/3bekoE

Core-Shell Micro/Nanodisks: Microencapsulation in Two Dimensions under Microgravity

Grade 8
Murray Hill Middle School, Howard County Public School System

Principal Investigator: Kevin He

Teacher Facilitator: Ed Chrzanowski, Science Teacher

Proposal Summary:
The experiment is primarily designed to study the effects of microgravity on the process of microencapsulation in two-dimensional membranes. Unlike on Earth, microgravity allows all liquids to form thin membranes in metal rings including pure water, which is known to be unable to form membranes under Earth's gravity. It is expected that the membrane will form core-shell micro/nanodisks or smaller-sized capsules in the microencapsulation process with dimensional constraints. The significant increase of surface area of these micro/nanodisk capsules or smaller-sized capsules would expedite their dissolution process, which may be needed for better control of drug release rates. Specifically, the experiment will be performed in a model system by mixing an aspirin solution and a gelatin solution in space. The mixture will form two-dimensional membranes on the thin platinum wire rings under microgravity through an apparatus. The liquid will then proceed naturally through the coacervation process to form microcapsules within the membranes. After the experimental sample is brought back to Earth, further analysis will be performed on their sizes and shapes using optical microscopy, as well as the concentration of aspirin in a simulated stomach acid

over 4 hours. The proposed experiment will not only provide fundamental understanding of microencapsulation in two-dimensional liquid membranes, but also open a door for further research on effective control of drug release.

8. Fitchburg, Massachusetts

Jump to Fitchburg's Community Profile: http://goo.gl/z5DYm3

The Production of Antibiotics from Bacillus subtilis in Microgravity

Grade 11
Montachusett Regional Vocational Technical School

Co-Principal Investigators: Liza Anderson and Samantha Bratkon

Co-Investigators: Ashley Monroe and Stephanie Tivnan

Teacher Facilitator: Paula deDiego, Chemistry Instructor

Proposal Summary:
The purpose of this experiment will be to monitor the production of antibiotics produced from *Bacillus subtilis* in microgravity compared to its production on Earth. To accomplish this we will send into space a freeze-dried sample of the cell with a growth medium and growth inhibitor, separated by two clamps in the tube. Two weeks prior to the departure from the ISS, the astronaut will release clamp A mixing the reactants. The activated *B. subtilis* will then be divided into two sections. Two days before the return of the rocket, the astronaut will mix one of the *B. subtilis* samples with its growth inhibitor. This is done so that after the growth medium and the *B. subtilis* are mixed, we will be able to compare the effects of microgravity on an activated sample versus a deactivated sample. The growth inhibitor is important because we will be able to monitor whether or not *B. subtilis* can be preserved and reactivated when necessary to ensure that health treatments can be available without the immediate support of Earth. During the same time period there will be an identical experiment conducted on Earth to provide data to compare with the results of the test in microgravity.

9. North Attleborough, Massachusetts

Jump to North Attleborough's Community Profile: http://goo.gl/GGk2Tj

If you cut a Dugesia Planarian worm would it grow back in microgravity?

Grade 6
North Attleborough Middle School, North Attleborough Public Schools

Principal Investigator: Chris April

Co-Investigators: David Pacitto and Lily Wetherbee

Teacher Facilitator: Jennifer Murphy, Science Teacher

Proposal Summary:
Regeneration is essential to all life forms here on Earth, but is it possible in microgravity? Our group's experiment is about whether or not a Dugesia Planarian worm can regenerate in microgravity. Our experiment should be put in microgravity to see if human life forms or any life forms would be able to heal a cut in microgravity. Our hypothesis is that the Dugesia Planarian worm will not be able to

regenerate in microgravity. We would test this on Earth by cutting the Dugesia Planarian worm in half and observing if it regenerates. We observed via internet video that the Dugesia Planarian worm would be able to regenerate on Earth. This experiment would be useful to future civilization if we ever had to move to a place that exposes us to microgravity. In addition, if someone were wounded it would be beneficial to know if we potentially are able to heal.

10. Kansas City, Missouri

Jump to Kansas City's Community Profile: http://goo.gl/0AkQNC

Oxidation in Space

Grade 8
St. Peter's School, Kansas City – St. Joseph's Diocese

Co-Principal Investigators: Anna Campbell, Zoe Butler, Maureen Egan, and Tone'Nae Bradley

Teacher Facilitator: Robert J. Jacobsen, Science Teacher

Proposal Summary:
We would like to determine the effect of microgravity upon the process of oxidation. This experiment is being observed because in a spacecraft, there is free flowing water that could damage (or rust) the metal of the interior and exterior of that spacecraft. The rusting of an iron nail will be studied as water is added to its section of the FME. We are looking to determine if oxidation (or rusting) occurs faster, slower, or at all because of microgravity.

11. Brookhaven, Mississippi

Jump to Brookhaven's Community Profile: http://goo.gl/RFNfTm

Polyhydroxyalkanoate Production in Zero Gravity

Grade 12
Brookhaven Academy

Co-Principal Investigators: Samantha Barton, Ashlea Bardwell, Garrett Smith, Ruth Vaughn, and Lindsey Winborne

Teacher Facilitator: Leslie Hood, Biology Teacher

Proposal Summary:
Will the bacteria, *Ralstonia eutropha*, maintain its ability to produce polyhydroxyalkanoates (PHA) while exposed to a zero gravity environment?

PHA is a biodegradable polyester that can be used to make many things such as medical sutures, vein valve replacement, skin grafts, and several other things. In earth's gravity, PHA is nontoxic to the human body, allowing it to be safely used for medical purposes (J. Bacteriol, July 2003).

PHA is a short chemical chain composed of a methyl or ethyl group, created by bacterial fermentation. The bacteria that will produce PHA in this experiment is *R. eutropha*, which is one of several bacteria that can produce PHA. The bacteria produce PHA through bacterial fermentation, which is a process that breaks down a carbon source in a nutrient broth leaving behind pellets of PHA, or plastic.

This experiment will determine whether *R. eutropha* maintains the ability to produce PHA in zero gravity. If the bacteria can make PHA after being exposed to zero gravity, it will allow for several medical components to be made in space such as medical sutures, vein-valve replacements, skin grafts, and several other things. This production of medical supplies in space will greatly improve medical care for astronauts in space.

12. Pennsauken, New Jersey

Jump to Pennsauken's Community Profile: http://goo.gl/iRIbiW

Penicillium Growth Rate in Microgravity

Grade 8
Pennsauken Phifer Middle School, Pennsauken New Jersey

Co-Principal Investigators: Franshayla Matias, Indyah Chatman, and Miguel Rios

Teacher Facilitator: Mr. T. Gilbride, Science Teacher

Proposal Summary:
What is the growth rate of *penicillium*? That is our question to our experiment. Penicillin is an antibiotic or group of antibiotics produced naturally by certain blue molds, and now usually prepared synthetically. Our hypothesis is that the growth of the antibiotic (penicillin) in microgravity will grow at a much faster rate. The plan for our experiment is that we're going to add apple cider in the test tube. But it has to be placed in a dark and warm surrounding. Then the antibiotic should start growing in about three to four days. You wouldn't have to add any more chemicals… it is east as that. How is this useful? *Penicillium* can actually be turned into a helpful drug. This helpful drug can be used to treat infections caused by bacteria.

13. New York City, New York - NEST+m

Jump to New York City's Community Profile: http://goo.gl/jjKEiV

What is the effect of microgravity on mold growth on white bread?

Grade 5
New Explorations into Science, Technology, and Mathematics, District 01

Co-Principal Investigators: Noor Ajam, Foyez Alauddin, and Alexander Harris

Teacher Facilitator: Margaux Stevenson, 5th grade teacher

Proposal Summary:
Our question is "What is the effect of microgravity on mold growth on white bread?" We want to do this experiment because before this experiment, we did not know very much about mold growth. It would be really cool to learn about a new topic in microgravity. For this experiment, we will use an FME type one tube. We will use it because the only substance our experiment requires is white bread. Our experiment has no determined initiation, so our procedure is to leave a small sample of white bread in an FME type one tube and to leave it alone for the duration of the mission. Our ground element has the same procedure.

The insight we hope to gain from this experiment involves mold starting out as dust. If there is a lot of

mold dust in the air, then it will crowd each other out, and naturally land on the bread. However, if there is little mold dust in the air, then microgravity will carry it away and then it will never land on the bread. Lastly, we plan to measure the results of our ground element and our microgravity element by measuring the area of the mold on the white bread in square inches. We also plan to observe the color of the mold and the color of the white bread. We plan to chart the data on a bar graph.

14. Rockland County, New York

Jump to Rockland County's Community Profile: http://goo.gl/zTftfx

Lettuce Growth

Grade 5
Cottage Lane Elementary School, South Orangetown Central School District

Co-Principal Investigators: Luke Rabinowitz, Colm Shalvey, and Zachary Visconti

Teacher Facilitator: Mrs. Nadler, Reading Teacher

Proposal Summary:
We will grow a lettuce plant and see how long it takes to germinate on Earth with no light. We will do this because it is dark on the Space Station. We will tell the astronauts to do the same thing we did on Earth but with microgravity. We will compare when it gets back home by looking at both germinations side by side. If it doesn't take long, maybe astronauts can grow and pick their own food in space. This will help because people don't have to waste money by sending up food.

15. Guilford County, North Carolina

Jump to Guilford County's Community Profile: http://goo.gl/mC8WXH

Artificial Ear?

Grade 6-8
Mendenhall Middle School, Guilford County Schools, Greensboro, NC

Co-Principal Investigators: James Galipeau, Praise Idika, and Liam Kennedy

Collaborators: Katrina Afocx, Sarah Deathrage, Favor Idika, Taya Kennedy, Ben Martin, Michael Purdie, Ellie Weeks, and Y Ricki

Teacher Facilitator: Lenny Sue French, MSed, Math/Science educator

Proposal Summary:
The purpose of this experiment is to see if the size of Calcium Sulfate crystals grown in space differs from those grown on Earth. The reason we are interested in this is because we learned that jellyfish born in space lacked the ability to sense direction after returning to Earth. We wondered if the same thing would happen to humans born in space. Jellyfish sense direction through crystals grown in follicular pockets (pockets with hair in them) along their rim. We wondered if the reason for the jelly vertigo could be due to larger crystal formation in the pockets.

In the FMEII we will place crystal powder in volume 1 and distilled water in volume 2. Once in microgravity an astronaut will release the clip and gently shake the tube to mix the ingredients and start the crystallization process.