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Stockton Will Send Spores to Space to Find Out If Fungus Can Aid Agriculture Beyond Earth

Student Experiment Selected to go to the International Space Station by the National Center for Earth and Space Science Education

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Contact: **Susan Allen**
News and Media Relations
Galloway, N.J. 08205
Susan.Allen@stockton.edu
(609) 652-4790
www.stockton.edu/media

Galloway, N.J. – On Earth, some plant roots and fungi form mutualistic relationships, known as mycorrhizae, that result in increased plant growth. Stockton University students designed an experiment to determine if the same holds true in a microgravity environment, where gravity is nearly absent.

Long-term space travel and the need for astronauts to sustain their food supply in space, led students Danielle Ertz and Valkyrie Falciani with faculty mentor Tara Luke, associate professor of Biology, to study fungus as a potential force for improving agriculture in space. Their experiment, "Spores in Space: The Effects of Microgravity on Endomycorrhizae," was chosen by the National Center for Earth and Space Science Education (NCESSE) to go to the International Space Station (ISS) as part of Mission 11 of the Student Spaceflight Experiments Program (SSEP).

During the upcoming spring semester, Ertz, a senior Biology major from Woodlynne, N.J., and Falciani, a Hammonton resident and Marine Biology graduate now in the Teacher Education program, will prepare their experiment for transport to the ISS aboard the Space X Dragon, a free-flying spacecraft.

Their experiment uses a mycorrhizal fungus species and flax. Flax was chosen because its seeds are edible, the plant can be used to make cloth, its extensive taproot system allows growth in limited space and it is proven to grow in space.

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The mycorrhizal fungus that was chosen is arbuscular, meaning that it infects plant roots with branches of hyphae that increase the surface area for two-way absorption. The fungus absorbs carbohydrates from the plant, and the plant absorbs minerals from the fungus.

The experiment consists of a fluid mixing enclosure (FME) mini-lab that will hold enough water, fungi spores and flax seed to grow for four to six weeks on the ISS. The same experiment will be conducted on Earth simultaneously as a scientific ground truth for later comparison.

“One of the biggest challenges we faced was making sure our idea would work within the apparatus. The entire experiment had to fit inside a small test tube,” explained Falciani.

Tara Luke, who explored the marine life inhabiting the deepest place on Earth, the Marianas Trench, over the summer, is excited to be exploring a new frontier. She said, “All exploration is my interest and I’m just as excited as the students” to see the experiment go 249 miles to the ISS.

“The students have put together a really good proposal and they found a way to find useful data regardless of the results, which is a great strength,” said Luke.

In their proposal, the students explained that their results will “provide a baseline of knowledge from which numerous other hypotheses may be explored.”

Ertz said, “It feels a little surreal that something that I helped think of is actually going to the ISS, but I'm also really glad and excited. Planning the experimental procedure was a challenge, but it was rewarding working as a member of a team because we were able to bounce ideas off of each other and find solutions.”

About her partner Ertz, Falciani said, “I never could have done this on my own and I will forever be grateful for all of the time we spent working on this project and for all of the things I have learned thanks to her.”

Falciani also noted the support from Luke, who helped to guide them, Dean Peter Straub who answered all of their plant questions, and Jeff Goldstein, NCESSE director, for invaluable advice and visiting Stockton to lecture about microgravity.

Currently scheduled for early June 2017, the experiment will launch from Cape Canaveral. Stockton SSEP is currently raising funds to send students to the launch and to present results at the SSEP National Conference at the Smithsonian National Air and Space Museum in Washington, D.C.

“We have a unique opportunity to educate those around us as to the importance of the space program and the role of scientists in advancing new knowledge necessary to support space travel,” said Straub, dean of the School of Natural Sciences and Mathematics and the project director.

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“This is a way for students to get a taste of the authentic scientific process, which is the heart of our general studies courses in science, showing them how scientists think and work,” Straub added.

During the fall semester, 11 teams of students mentored by faculty members used principles of chemistry, biology and physics to design experiment proposals to be tested by astronauts in weightless conditions aboard the ISS. Of all the experiments, Stockton sent three finalists to the NCESSE to be reviewed by the SSEP Step 2 Review Panel.

Students Musfiq Atul and Kayla Hope, who were runners-up, with mentor Jason Shulman, assistant professor of Physics, designed an experiment that focuses on the effect of microgravity on autophagy in yeast. Autophagy is the degradation and recycling of cellular components and was the subject of the 2016 Nobel Prize in Physiology or Medicine.

Student Ariel Petchel, who was also a runner-up, designed an experiment with mentor Luke looking at the effects of microgravity on gene expression in cyanobacteria, which are photoautotrophs or organisms that produce their own food using sunlight and carbon dioxide. They also produce oxygen as a byproduct of this reaction, so may be useful for producing oxygen for humans traveling in space.

In addition to Luke and Shulman, Pamela Cohn, assistant professor of Chemistry, and Straub served as mentors.

The Student Spaceflight Experiments Program 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 DreamUp PBC and NanoRacks LLC, which are 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.

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