Experiment seeks changes in yeast's genetic expression in microgravity conditions

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Project manager John Carver prepares the Advanced Plant Experiment (APEX) at the Space Station Processing Facility at NASA's Kennedy Space Center in Florida. The study will launch with the SpaceX-3 mission to the International Space Station. Credit: NASA/Kim Shiflett

Growing knowledge in a given field takes time, attention, and…water? It does when you're talking about plant studies aboard the International Space Station (ISS). All of these things and some scientific know-how come into play as astronauts find out just how green their thumbs are

while assisting researchers on the ground.

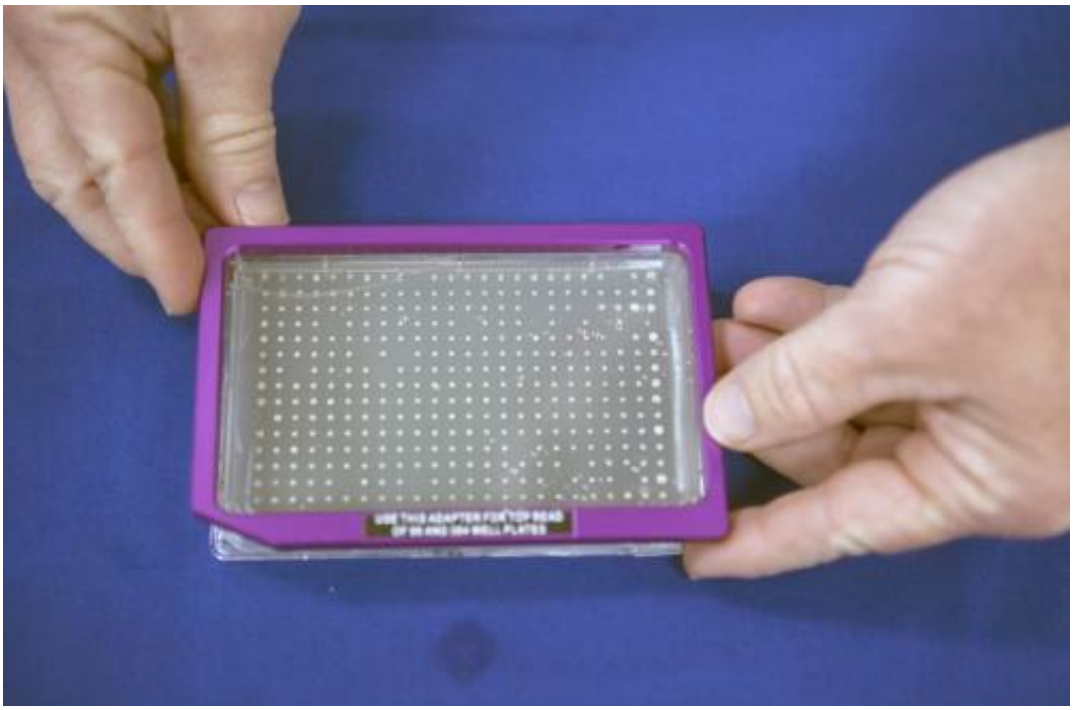
The crew will assist with the Advanced Plant Experiments (APEX) investigation, a series of studies on the effects of the spaceflight environment on biological systems. Next in the APEX series is the APEX-02-2 study that launched to the space station aboard the Space Exploration Technologies (SpaceX) Dragon capsule on the SpaceX-3 resupply mission.

SpaceX-3 is the third station resupply flight under NASA's Commercial Resupply Services contract.

Using Petri plates of common brewer's yeast, or Saccharomyces cerevisiae, scientists hope APEX-02-2 will help them pinpoint specific changes in the yeast's genetic expression when exposed to microgravity conditions.

Given that yeast is an eukaryotic organism, as are humans, the results will be applicable to organisms higher in the evolutionary chain than bacteria, which are prokaryotic cells. Researchers anticipate that their observations of yeast as a model for how cells adapt to microgravity will help them to better understand how more complex organisms evolve.

Ground testing and processing of the payload took place inside the Space Station Processing Facility at NASA's Kennedy Space Center in Florida. Overseeing the project is payload manager Jose Camacho, who previously managed the Biological Research in Canisters-17 (BRIC-17) space station study, which launched on SpaceX-2 in 2013.



A portion of the Advanced Plant Experiment (APEX) as it is prepared for launch to the International Space Station aboard a SpaceX Dragon spacecraft. The SpaceX-3 mission is the third of 12 flights contracted by NASA to resupply the orbiting laboratory. Credit: NASA/Kim Shiflett

Camacho started his career with NASA as an electrical engineer working in the ISS Electrical Power Systems group and then migrated to integration engineer, or systems engineer. "I would say my experience as a systems engineer along with an engineering management degree was what qualified me for this position," Camacho explained.

APEX-02-2 is a late stow payload and was turned over to the cold stowage team at L-72 (launch minus 72) hours for installation in the Dragon capsule at L-24 hours.

The flight samples—a total of 10 plates containing 384 yeast dots per plate—arrived at Kennedy on March 7, and were integrated into kits of

five plates each. Each kit also contains "a HOBO temperature data logger to monitor temperature from the time they leave our hands to the time we get them back," Camacho said.

Freezing the yeast will kill them so it is important to confirm that the temperature inside the kits does not drop below zero degrees. Once aboard the station, the plates will be inserted into the NanoRack's plate reader facility.

"Plates will be kept at 4 degrees C [39.2 degrees F] until just prior to installation into the plate reader," Camacho said. "While in the plate reader, the plates will be warmed up to 30 degrees C [86 degrees F], allowing the yeast to grow."

This library of yeast clones was constructed robotically. Each clone has been tagged with a green and red fluorescent protein-linked marker so that researchers can monitor the expression of each of the 3,840 yeast genes.

Two identical sets of plates will be cultivated in ground tests and used as control sets. The conditions for the ground plates will be as similar to those in the flight environment as possible to help isolate the variable of gravitational force.

"Each plate will remain in the plate reader for a total of 18 hours where it will be scanned or read every 10 minutes," Camacho said. "Five of the 10 plates will be returned refrigerated at 4 degrees C, and the remaining five plates will be returned at ambient air temperature."

Data from the plate reader on station will be downlinked daily over a period of 11 days and provided to researchers for further analysis and comparison with the control data from the plate readers on the ground.

When the APEX-02-2 samples are returned to Earth, both the flight and ground plates will be shipped to a lab at the University of British Columbia, Canada, for radiation assessment. After the data collected from APEX-02-2 are tallied, they will be made available online.

APEX-02-2 is part of a new collection of investigations developed to expand life science research on the station, called geneLAB. These investigations represent NASA's leading effort to develop next-generation life science research capabilities that will help scientists understand the role genes play in human health and disease on Earth as well as to benefit humans traveling into space.

Provided by NASA