

Botanist Sends Plant Seeds to ISS

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Miami University botany professor John Kiss with seed cassette experimental containers. Credit: Miami University

When the space shuttle Discovery launches July 1 it will carry the research of Miami University professor John Kiss to continue studying if we can grow food in microgravity.

Kiss' project is one of only two experiments launched on Discovery that will actually be performed on the International Space Station at this time. Kiss, professor of botany, has been awarded more than \$1 million by NASA over the past six years for "Tropi, Analysis of a Novel Sensory Mechanism in Root Phototropism," an experiment to study how plant roots respond to varying levels of both light and gravity.

Insights gained from Tropi can help create sustainable plant-based life support systems for long-term space missions, which are part of NASA's exploration agenda, according to Kiss. Plants will be needed as a food source and as oxygen producers on long-range trips to Mars, for example.

Tropi consists of dry *Arabidopsis thaliana* (thale cress) seeds stored in small seed cassettes, explains Kiss. The seed cassettes will be flown inside the European Modular Cultivation System (EMCS), an experiment facility for biological investigations under microgravity. A large (655 pound) incubator, EMCS provides control over atmosphere, lighting and humidity of growth chambers.

Tropi will be the first experiment performed in the EMCS, which was developed by the European Space Agency. The experimental containers (EC) were developed by Kiss' group and NASA, based on a design by project co-principal investigator Richard Edelman, director of Miami's electron microscopy facility.

Space Shuttle Discovery will deliver supplies, equipment and a new crew member (European Space Agency astronaut Thomas Reiter) to the ISS. Once on board, Tropi experiments will be performed automatically inside the EMCS, requiring minimal involvement by the Expedition 13 crew members.

According to Kiss, spaceflight procedures require loading the ECs into the EMCS, replacing videotapes and harvesting plants when they are grown. Harvested plants will be stored in a minus 80-degree laboratory freezer until their return to Earth.

Once the samples from Tropi arrive back on Earth — estimated to be by the end of the year — data analysis will begin. Plant germination, growth and curvature will be analyzed from the videotapes, and DNA analysis

will be conducted on the frozen plant samples to determine how the different light and gravity treatments affect gene expression.

Kiss and Edelmann also had experiments on gravitropism (how plants respond to gravity) on two space shuttle missions in 1997.

Plants may be able to be used in bioregenerative life support on Mars, says Kiss. They can be engineered to grow under the stresses of long-term space flight such as water deficits and high ethylene concentrations, or under stresses unique to other planets such as Mars.

Coincidentally, just last week, astrophysicist Stephen Hawking stated in a lecture in Hong Kong that for the survival of the species, humans should develop space settlements that can continue without support from Earth.

Source: Miami University

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