NEWS RELEASE

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Far Out! NC State to Provide Experimental Plants for International Space Station Studies

FOR IMMEDIATE RELEASE

A proposal by North Carolina State University researchers to put genetically modified plants on the International Space Station to study the effects of fractional gravity on the plants' signaling processes has been accepted by NASA.

The project, says Dr. Christopher Brown, a research associate professor of botany at NC State and director of space programs for the Kenan Institute of Engineering, Technology & Science, housed at NC State, will represent an important step toward learning more about how plants respond to the weightless conditions in low earth orbit, or to gravity levels found on the moon or Mars.

The research would entail sending into space *Arabidopsis*, or mustard weed, plants that have been genetically altered with reduced levels of IP_3, a molecule that is critical in converting stimuli into biochemical events. *Arabidopsis* is frequently used in scientific experiments because it develops, reproduces and responds to stress and disease in much the same way as many crop plants. The entire genome of *Arabidopsis* has been sequenced, allowing researchers to delve into the genetic basis for many plant responses.

On Earth, reduced levels of IP_3 in modified plants translate into slower and diminished response to changes in the direction of gravity on Earth. "When the modified plants are tipped, the shoots and roots do not re-orient as quickly or as completely as wild-type plants – those that are not genetically modified," Brown says.

Now, the NC State research team, which includes botanists Dr. Wendy Boss, Dr. Imara Perera and Dr. Heike Winter-Sederoff, is looking to see if these responses change under no gravity, or weightlessness; one-sixth gravity, which represents gravity on the moon; and three-eighths gravity, which represents gravitational conditions on Mars.

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"One of the earliest plant responses to changes in the direction of gravity on Earth is a change in levels of IP_3," Brown says. "This in turn causes increases in cellular levels of calcium, for instance, and other levels of gene expression starting a cascade of events that eventually leads to the plant response – which is to bend. We want to see if the different gravity levels – weightless, moon and Mars – result in a similar response in our altered and wild-type plants."

To test plant responses at the different gravitational conditions, the NC State plants – both wild-type plants as well as the genetically manipulated plants – will spin inside an International Space Station centrifuge, a machine that accelerates plants to produce artificial gravity. According to Brown, "Other than being on the surface of the moon, Mars or another smaller planet, this is the only way to get gravity levels between 0 and 1."

But before the plants go into their cosmic spin, the NC State researchers will work to ensure the plants are safe within the centrifuge. Since there's not a lot of room on the International Space Station, the centrifuges are small – "about the size of a small suitcase," Brown says – and the plant-growing chambers are smaller yet, no larger than a brick.

To get to the International Space Station, the plants must travel on a NASA space shuttle. Craft like the Russian "Soyuz" or "Progress," spacecraft that are currently the only way to ferry crew, essential gear and supplies to and from the International Space Station, simply do not have enough room to carry up much else. The space shuttle's return to flight is scheduled for May or June 2005, and even then it may be one to two years before the experiment can fly. "No problem," Brown says. "There is a lot to do to get ready in the meantime."

NASA's vision for the future of space exploration is "human and robotic exploration of the moon, Mars and beyond," according to Brown. Plants would provide space travelers with a number of critical life-support basics, including air and water. Besides these basics, plants would also supply fresh food and greenery, which would provide a much-needed psychological lift to the crew, a must on long-term missions.

"NASA wants to know if a plant-based bio-regenerative life-support system is feasible and cost-effective for long-term missions, like a multi-year expedition to Mars, for example," Brown says.

The proposal stems from research in the NC State NSCORT program, the NASA Specialized Center of Research and Training in Gravitational Biology, Brown says. "NC State is a national and international player in NASA-relevant plant research, and this project is a natural progression from our work in the NSCORT program," he says.

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