

1. Experiment Title

Studies on the role of auxin efflux facilitators in the gravity-influenced growth and development of plants

2. Principal Investigator

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3. Outline of Experiment

This study is aimed at understanding the mechanism for controlling auxin dynamics that plays a major role in gravimorphogenesis and tropisms in plants.

Plants control their morphology and orientation by utilizing gravity as a biological signal. PI and his colleagues found that gravity affects the expression of an auxin efflux facilitator and thereby auxin dynamics important for gravimorphogenesis in plants. In addition, roots display not only gravitropism but also hydrotropism. Because the former often masks the latter on Earth, however, mechanism for hydrotropism has not been well investigated. PI and his colleagues showed a possibility that the interference between these tropisms occurs due to the competitive dynamics of an auxin efflux facilitator. In this proposed experiments, microgravity environment is used for verifying the gravity-regulated dynamics of auxin efflux facilitators and its role in gravimorphogenesis of plants. Also, hydrotropism is distinguished from gravitropism in microgravity, and the dynamics of an auxin efflux facilitator in each tropism is analyzed for clarifying the mechanisms and the interaction of the two tropisms.

Cucumber seedlings are used in this spaceflight experiment. The experimental system established by the group of PI is installed into V-MEU to be placed in CBEF. Plant materials are chemically fixed and stored in freezer for return to the ground and subjected to post-flight analyses of morphology, growth orientation, and expressions of proteins and genes.

The results to be obtained from this study brings about fundamental knowledge on molecular mechanisms of the gravity-influenced growth and development in plants, which becomes a basis for developing techniques efficient to grow plants in space as well as on Earth.

4. Experiment Facility

Cell Biology Experiment Facility (CBEF)
Clean Bench (CB)
Video Measurement Unit (V-MEU)
The Minus Eightys Degree Celsius Laboratory Freezer for the International Space Station (MELFI)