1. Title
   FY2004 Ground-based Research Program for Space Utilization Research Report

2. Research Term
   FY2004〜2006

3. Research Fields
   Life Science

4. Research Categories
   Priority Research for KIBO Utilization

5. Research Theme
   Mechanisms of Signal Transformation and Transduction in Gravity Resistance in Plants

6. Investigators
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7. Organization
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8. Summary of Research
   Resistance to the gravitational force is a principal graviresponse in plants, comparable to gravitropism. Nevertheless, only limited information has been obtained for this graviresponse. The present study aims to clarify the mechanism of signal transformation and transduction processes, with reference to the roles of the plasma membrane and cortical microtubules.
Under hypergravity conditions, the expression of 3-hydroxy-3-methylglutaryl-Coenzyme A reductase (HMGR) was up-regulated, and the level of membrane sterols was kept higher, without influencing the level or composition of other membrane components. On the other hand, the expression of the majority of α- and β-tubulin genes was up-regulated and the percentage of cells with longitudinal cortical microtubules was increased by hypergravity. Also, increases in the level and molecular size of anti-gravitational xyloglucans and 1,3,1,4-β-glucans by gravity were brought about by suppression of their breakdown with their constant or enhanced biosynthesis. We have further examined the role of membrane sterols and cortical microtubules in gravity resistance using *Arabidopsis* mutants. Elongation growth of both hmg and tubulin mutants was suppressed even under 1 g conditions, and hypergravity did not influence their growth, suggesting that the mutation made plants hypersensitive to the gravitational force. The analysis with mutants has revealed that the signal transduction process via membrane sterols is distinct from that via cortical microtubules. These results indicate that membrane sterols and cortical microtubules are deeply and independently involved in maintenance of normal growth capacity against the gravitational force. To confirm this hypothesis, we have also decided the procedure for space experiments.

9. Publication List


10. URL

http://www.sci.osaka-cu.ac.jp/biol/pphys/index-e.html