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# "RHIZOGENESIS IN VITRO" AS A NEW MODEL FOR SPACE AND GRAVITATIONAL BIOLOGY.

**Abstract**

It is generally accepted that plants are irreplaceable components of Bioregenerative Life-Support Systems, as far as they are sources of oxygen and food for crew, CO2 absorbers, regenerators of water through participation in recycling of organic wastes, and also green design for astronauts psychological comfort. The most used objects to study of plant cell gravisensitivity are roots because the sites for gravity perceiving and growth responses are separated spatially. It should to note that embryonic roots emerge from seeds formed on Earth at 1g. Therefore, a new model "Rhizogenesis in vitro" is proposed to study the processes of cell division, differentiation, and functioning in roots formed de novo in vitro culture in real and simulated microgravity. We used *Arabidopsis thaliana* plants of wild type and DR5rev::GFP. Root anatomy, cell ultrastructure and auxin distribution were analyzed with microscopes Axipscope, transmission electron JEM 1230 and laser scanning microscopes LSM5 PASCAL respectively. It was shown that roots in vitro initiated from cambium cells of petiole vascular bundles of leaf explants. They had a root cap and growth zones (meristem, distal elongation zone, central elongation zone, and mature zone). A root cap consists of columella and peripheral cells. In the columella there are meristematic cells, statocytes (graviperceptive cells), and secretory cells. Statocytes preserved their polarity in control but under clinorotation, amyloplasts were mainly revealed a tendency to group in the cell center, rarely – in the cytoplasm whole volume. These data confirm that amyloplasts do not perform their function as statoliths in simulated microgravity. Cells of different growth zones had the typical structure. Auxin localization in roots, which formed de novo and grew vertically, was observed in a central cylinder and in the columella and peripheral cells. Under clinorotation, DR5rev::GFP signal was noted only in cap cells but it was absent in root cortex. Root gravistimulation after clinorotation promotes the appearance of DR5rev::GFP in the cortex, that is an evidence of a gravitropic reaction. It is of interest to use a model of "Rhizogenesis in vitro" in spaceflight experiments, i.e. in real microgravity, to investigate gravisensitivity and gravidependence of plant cell differentiation and function, as well as auxin distribution in roots before and after gravistimulation in the control and experiment.