SPACE LIFE SCIENCES SYMPOSIUM (A1)
Biology in Space (8)

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FLUMIAS – 3D LIVE CELL IMAGING UNDER MICROGRAVITY

Abstract

FLUMIAS (Fluorescence-Microscopic Analysis Systems for Space Application) is a cutting edge laser-based fluorescence microscopic analysis system for biological and biomedical space applications developed by Airbus together with FEI Munich on behalf of DLR Space Administration for high-resolution 3D live cell imaging in space.

Central component of FLUMIAS is the spinning disc unit which allows for the parallel scan of thousands of image points. The system offers good axial (Δz approx. 1.5 μm) and lateral (Δx, Δy approx. 0.4 μm) resolution, low photo bleaching compared to a point scanner and in combination with a modern sCMOS camera a fast image acquisition. Possible excitation wavelengths at the moment are 405/488/561/642 nm. For the first time in a space environment FLUMIAS enables time lapse experiments and 3D-microscopic analyses of rapid cellular and intracellular processes like e.g. ion-fluxes, organelle movements and dynamics of cytoskeletal architecture and protein re-localization. This facilitates researchers to study the effects of weightlessness inside the cells with live-cell imaging and provides a useful tool to verify various hypotheses regarding biological processes.

After having successfully tested FLUMIAS on the 24th DLR parabolic flight campaign in February 2014, a FLUMIAS version has been manufactured and integrated as a payload module for three German experiments and was flown on the TEXUS 52 sounding rocket mission in April 2015. FLUMIAS can be adapted to multiple different sample types like plant roots, and can be used in parabolic flights, sounding rockets and centrifuges.

The participating German teams (Kohn, University of Hohenheim; Ullrich, University of Magdeburg and Zurich) investigate human cells and are especially interested in the behavior of the cytoskeleton.