

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences Onboard the International Space Station and Beyond - Part 2 (7)

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SHAKEN NOT STIRRED: COMPARATIVE STUDIES USING 2D-CLINOSTAT AND RANDOM
POSITIONING MACHINE

Abstract

In the ESA ground-based facility program, clinostats and Random Positioning Machines (RPM) have been applied to simulated microgravity, while centrifuges served as a hypergravity model. First results of cell-based experiments have been recently published*. The results clearly demonstrate that device-specific operational modes have to be considered and discussed with respect to the induction of shear forces and in turn their usability as microgravity simulators: In a RPM samples are rotated around two axes with random velocities and directions, while clinostats apply constant rotation around one axis.

We will present examples of current investigations visualizing cellular shear forces within a RPM and a clinostat using Dinoflagellates as well as macrophages as cellular reporter systems. The latter has already been studied under real microgravity conditions. We conclude that one axis clinorotation induces substantially less shear forces in comparison to random positioning. Therefore, fast-rotating clinostats provide more valid information and should be preferred for the simulation of microgravity in cellular experiments.

We believe that this work provides important new insight on the use and limitations of ground-based facilities for the scientific community, which will be crucial in the upcoming post-ISS scenario.

*Topical Issue: Ground-Based Facilities (GBF): Results and Experiences from ESA's Ground-Based Facilities Programme in Space Life Sciences, eds. Hemmersbach, R., Ngo-Anh, J., Zell, M., Microgravity Science and Technology, ISSN 0938-0108 Volume 28, Issue 3, June 2016