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Author: Prof. Araceli Espinosa-Jeffrey
UCLA, United States, aracelisakura8@gmail.com

Mr. Kevin Nguyen
UCLA, United States, kevinnguyen4587@gmail.com
Dr. Alana Taniguchi
United States, alanamt@hawaii.edu
Dr. Laurent Veergnes
United States, lvergnes@g.ucla.edu
Mr. Ochiai Toshimasa
MHI, Japan, 'toshimasa_ochiai@mhi.co.jp'
Prof. Jean de Vellis
UCLA, United States, jdevellis@mednet.ucla.edu

CHANGES IN ENERGETICS-ASSOCIATED MOLECULES, ENHANCED PROLIFERATION AND OXYGEN METABOLISM IN OLIGODENDROCYTES GROWN IN SIMULATED MICROGRAVITY

Abstract

It has been shown that depending on the cell type, microgravity induces apoptosis, alters the cytoskeleton and affects differently signal transduction, cell differentiation, proliferation, migration and adhesion (rev. Studer et al., 2011). Nonetheless, only a few aspects on the sensitivity of neural cells to weightlessness (0G) have been examined. Magnetic resonance imaging from astronauts exposed to microgravity (G) while working on space missions has revealed intracranial hypertension that is a risk factor and it could become a potential limitation to long-duration space missions. We have pioneered the study on the impact of simulated microgravity (sim-G) on human neural cells, in particular neural stem cells (NSCs) and oligodendrocyte progenitors (OLPs). We have recently reported that neural cells proliferate more in simulated microgravity. Using proprietary chemically defined medium and a 3D-Clinostat we subjected these cells to sim-G and found enhanced and sustained proliferation with a concomitant shortening of the cell cycle. Time-lapse microscopy showed that OLPs migrate to a greater extent after exposure to stimulated microgravity than in 1G. OLPs showed a significantly delayed expression of mature markers like CC1 and MBP with a concomitant increased number of cells that retained immature OL markers such as Sox2 and NG2. We have also observed a number of other changes in biological processes including oxygen consumption rates that are enhanced in OLPs exposed to sim-G. We have found changes in energetics-associated metabolites that may corroborate high energy demand. Glucose Metabolism: Glucose can be utilized to support a variety of physiological processes, including energy generation, fatty acid synthesis, protein glycosylation, and nucleotide biogenesis. Decreases in environmental glucose indicate high glucose demand in our cells. We also saw increases in lactate that are suggestive of increased glycolytic use in sim-G. Fatty acids also tended to increase in OLPs in 0G vs 1G. These data together indicate the high demand of energy by OLPs maintained in sim-G. CG-NIH304612 and NASA: NNX15AB43G