Microglia under simulated microgravity: a novel strategy for chronic pain relief

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During spaceflight astronauts are exposed to microgravity (mg), which has relevant effects on physiological functions by leading to pathological conditions such as osteoporosis, loss of muscle mass and neurological disorders (1,2). Indeed, previous studies have demonstrated that weightlessness causes severe damage to the cytoskeleton of osteoclasts, lymphocytes and glial cells in cultures, the latter fundamental for brain function and essential for the normal health of the entire nervous system. It is known that microglial activation is involved in many chronic degenerative diseases included Alzheimer's Disease (AD), Parkinson's Disease (PD), neuropathic and inflammatory pain (3). Microglial cells are highly sensitive to mechanical forces and chemical challenges such as the bacterial endotoxin lipopolysaccharide (LPS).
Here, we have investigated the microgravity effect on the microglial phenotypical changes associated with spinal neuronal sensitization in chronic pain, using a tri-dimensional random positioning machine (3D-RPM) as a simulation method for microgravity. We found that the microgravity after 1, 3 and 24 h prevented the LPS-induced microglial activation remaining in a preferential 'resting' phenotype. Moreover, *in vivo* electrophysiological analysis revealed that topical microglia application significantly reduced the spinal neuronal hyperexcitability induced by a peripheral kaolin/λ-carrageenan injection in rats, after 24 h exposition of simulated microgravity, possibly driven by an increased release of IL-10 from microglia. Our findings add new insight in microglial physiology and possible future application also on *in vivo* model of chronic degenerative diseases.

Lazerges, M. Acta Astronautica 22, 375– 380, 1990.
Sumanasekera, W.K., Zhao, L., Ivanova, M., Morgan, D.D., Noisin, E.L., Keynton, R.S., Klinge, C.M. Cell Tissue Res. 324, 243–253, 2006.
McGeer PL, McGeer EG. Trends in Molecular Medicine.2002a;8:519–523.