Houston we have a problem: Microgravity accelerates biological aging

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As nations strive to put humans farther into space for longer periods of time, the real loser in this new space race could be the astronauts themselves. That's because experiments conducted on the International Space Station involving cells that line the inner surfaces of blood vessels (endothelial cells) show that microgravity accelerates cardiovascular disease and the biological aging of these cells. These findings are presented in a new research report published in November 2013 issue of *The FASEB Journal*.

"Understanding the cellular and molecular events of senescence might help in finding preventive measures that are useful to improve the quality of life of millions of people," said Silvia Bradamante, a researcher involved in the work from the CNR-ISTM, Institute of Molecular Science and Technologies in Milan, Italy. "Our study further supports the role of oxidative stress in accelerating aging and disease."

In this report, Bradamante and colleagues examined endothelial cells in real microgravity aboard the International Space Station and conducted deep gene expression and protein analysis on the cells. They compared space-flown endothelial cells to endothelial cells cultured under normal gravity, looking for differences in gene expression and/or in the profile of secreted proteins. Space-flown cells differentially expressed more than 1,000 genes and secreted high amounts of pro-inflammatory cytokines. Ultimately, this induced significant oxidative stress, causing inflammation among endothelial cells, which in turn, led to atherosclerosis and cell senescence (biological aging).

"As we plan to send people deeper into space than ever before, and for longer flights, we've got to make sure that they remain in best health possible," said Gerald Weissmann, M.D., Editor-in-Chief of *The FASEB Journal*. "We've evolved to rely on gravity to regulate our biology, and without it, our tissues become confused. Worst of all: they age faster!"

More information: Silvia Versari, Giulia Longinotti, Livia Barenghi, Jeanette Anne Marie Maier, and Silvia Bradamante. The challenging environment on board the International Space Station affects endothelial cell function by triggering oxidative stress through thioredoxin interacting protein overexpression: the ESA-SPHINX experiment. FASEB J November 2013 27:4466-4475; DOI: 10.1096/fj.13-229195

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