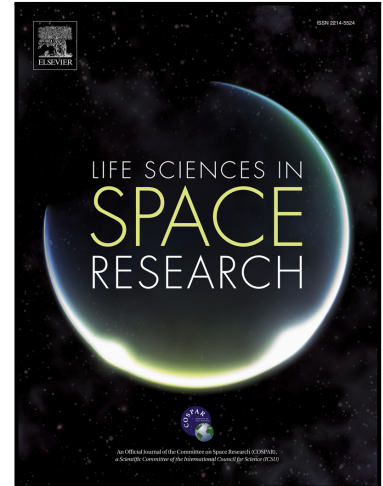


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Life Sciences in Space Research

High LET Radiation Shows no Major Cellular and Functional Effects on Primary Cardiomyocytes in Vitro

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Abstract

It is well known that ionizing radiation causes adverse effects on various mammalian tissues. However, there is little information on the biological effects of heavy ion radiation on the heart. In order to fill this gap, we systematically examined DNA-damage induction and repair, as well as proliferation and apoptosis in avian cardiomyocyte cultures irradiated with heavy ions such as titanium and iron, relevant for manned space-flight, and carbon ions, as used for radiotherapy. Further, and to our knowledge for the first time, we analyzed the effect of heavy ion radiation on the electrophysiology of primary cardiomyocytes derived from chicken embryos using the non-invasive microelectrode array (MEA) technology. As endpoints electrophysiological beat rate and field action potential duration were analyzed.

The cultures clearly exhibited the capacity to repair induced DNA damage almost completely within 24 hours, even at doses of 7 Gy, and almost completely recovered from radiation-induced changes in proliferative behavior. Interestingly, no significant effects on apoptosis could be detected. Especially the functionality of primary cardiac cells exhibited a surprisingly high robustness against heavy ion radiation, even at doses of up to 7 Gy. In contrast to our previous study with X-ray the beat rate remained more or less unaffected after heavy ion radiation, independently of beam quality. The only change we could observe was an increase of the field

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