AO-10-IBER-13: Osteoblast Like Cell Culture Model Systems In Response to Space relevant Qualities of Ionizing Radiation (OSIRIS 2.0)

P. Lau[1], Y. Hu[1], C.E. Hellweg[1], C. Baumstark-Khan[1], A. Groo[3], E. Tobiasch[2], and G. Reitz[1]

[1]DLR, Köln, Germany; [2]University of Applied Sciences, Bonn Rhein-Sieg, Rheinbach, Germany; [3]GSI, Germany.

Space travel produces many challenges to human health, including radiation exposure and musculoskeletal disuse. Bone forming osteoblasts are derived from undifferentiated mesenchymal stem cells. In this study, we used human adipose tissue derived stem cells (ATSCs) to investigate cellular survival (**Fig.1**), and differentiation after radiation exposure, as well as supplementation through osteogenic medium additives (50 µM L-ascorbic acid, 10 mM β-glycerophosphate and 10^{-8} M dexamethasone), (**Fig.2**).

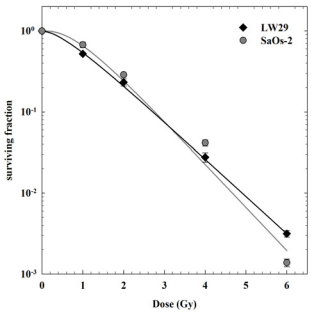

Figure 1: Survival curves of LW29 and SAOS-2 cells exposed to radiation doses up to 6 Gy.

Quantitative determination of bone cell differentiation was performed by analyzing the hydroxyapatite content of the ECM. Three days after seeding, culture medium was changed to osteogenic medium. Calcium rich deposits were confirmed less well formed regarding LW24 in comparison to the osteosarcoma cell line SAOS-2.

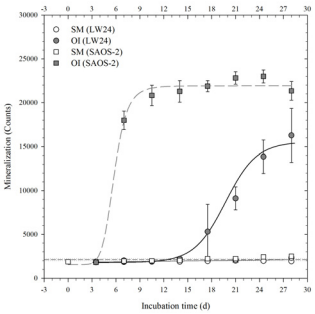

Figure 2: Cells were seeded three days before addition of osteogenic medium additives. Fluorescence was read out by using the microplate reader Lambda Fluoro 320 by using excitation / emission wavelengths of 485 / 535 nm.

Up to know few studies have evaluated the effects of low- and high-LET exposure on cell cycle regulation of ATSCs. In this study, cells were exposed to X-rays as well as to Ti-ions (1000 MeV/A; LET 107.7 keV/µm) in a dose range between 1 and 4 Gy, respectively.

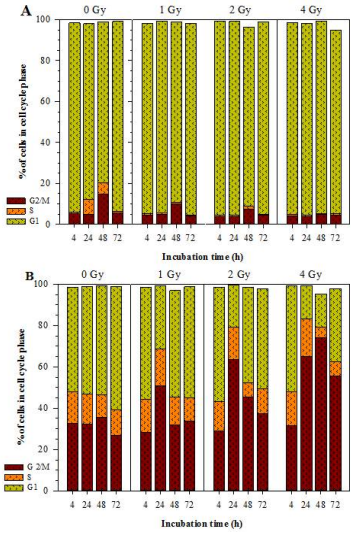

Figure 3: Cell cycle distribution after exposure to Ti-ions. Data for SAOS-2 (A) and LW24 (B) are shown as percentage of cells in the cell cycle phases G1, S and G2/M.

Cell cycle distribution of LW24 cells were only marginally affected (**Fig. 3A**) whereas a significant and dose-dependent arrest of SAOS-2 cells was detected after exposure to Ti-ions (**Fig. 3B**).

Outlook

Our findings provide a better understanding of radiation-induced biological response of ATSCs and may lead to the development of better strategies for stem cell treatment and cancer therapy. However, a detailed gene expression analysis in future work is required, to unravel intracellular responses after exposure to high-LET radiation.

Acknowledgement

We would like to thank all physicists at the GSI for their outstanding help. Bikash Konda, Claudia Schmitz and Sebastian Feles are acknowledged for their valuable help during all performed beam times.