Purpose: The zebrafish, *Danio rerio* has in recent years become a preferred model to study human disease. Our aim was to test the new micro-irradiator for its capability to perform basic radiobiology experiments, in particular to investigate relationship between radiation, apoptosis and inflammatory response.

Materials and Methods: A novel micro-irradiator, which enables high dose radiation of biological samples below 1 mm, was used to irradiate zebrafish embryos at different age post-fertilization. Two experiments were performed – total body irradiation and partial body irradiation. In total body irradiation, the embryos were irradiated up to 40 Gy and the amount of surviving neutrophils as a function of time was analyzed. In partial-body irradiation, only zebrafish embryo tails were irradiated to 20 Gy and time-dependent apoptotic and inflammatory response was assessed. FITS-labeled neutrophil-specific antibody protein myeloperoxidase was used for neutrophil labeling and TUNEL assays were used for apoptosis labeling.

Results: In total body irradiation experiments, little effect was observed at earlier time points post irradiation, but a sharp decrease in the number of neutrophils was observed at 72 hours post irradiation (hpi) suggesting that inflammatory cells can be completely ablated. In partial body irradiation experiments the inflammatory response seems to follow apoptotic response. Significant apoptotic and inflammatory activity was observed at few hours after irradiation, which slowly decreased to almost no activity as early as 24 hpi.

Conclusions: Our new micro-irradiator can perform unique radiobiological experiments. Preliminary results investigating relation between irradiation, apoptosis and inflammation indicated severe post-treatment cell ablation effects for total body irradiation and early apoptotic and inflammatory response within 24 hours post irradiation.